

Performance Indicators for ES&H

Report Period Ending
June 1997

January 1998

Office of
Environment,
Safety and Health



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Introduction

Assessment

The purpose of this Performance Indicator Report is to serve as both a corporate level report on how DOE is doing in ES&H, as well as a stimulus to those in the DOE Complex to perform more fact-based analysis. It is difficult to gauge whether DOE operations are getting "safer" based on the analysis in this report. However, when broken into components such as the 23 indicators in this report, some conclusions may be asserted. Nine indicators continue a positive trend. One indicator is moving in an unfavorable direction. Four indicators are not exhibiting a trend. Lastly, no conclusion can be drawn on 8 indicators either due to insufficient data or inconsistent behavior. The following are specific observations:

- The most recent lost workday case rate information fell below the DOE average for the fourth straight quarter (see PI-1). This rate is also the lowest quarterly rate since the current data collection system began keeping statistics in 1990 and is substantially lower than the rate from the same period last year (37% lower).
- The cost associated with worker injuries (OSH Cost Index, PI-2) is the lowest since we started collecting data in 1990.
- As reported in the our last report, there is still an increasing trend in the number of industrial operations safety related events with another fatality being recorded this quarter. In this case the event took place at Brookhaven National Laboratory and involved a contract construction worker being struck and killed by a front-end loader.
- The number of Price Anderson Amendments Act Enforcement cases reviewed increased substantially this quarter (see PI-9). The increase is due to the enforcement program infrastructure development. Of note is the fact that, though the number of cases jumped, there were no civil penalties imposed as of the end of the quarter.
- As reported in last quarter's report, the number of radiological events remained steady (see PI-12). However, as was also the case last quarter, the number of confirmed internal contamination events continued to increase. In one event a worker received a 50 year committed effective dose equivalent (CEDE) of 17 rem, exceeding the annual federal limit of 5 rem.
- The number of near miss and safety concern events increased for the third quarter in a row (see PI-13). This represents a potential trend that bears watching. Of these events, electrical safety related events make up the majority. This is similar to last quarter.

Detail Opportunities

During the past year, we have had two DOE field personnel detailed to our office for approximately 90 days each to work on performance indicator and operating experience analysis. We gain valuable insight to improve our products and the detailees benefit from exposure to ES&H analysis techniques and become familiar with DOE headquarters activities. If your office wishes to nominate a person for this program, please contact us for more information.

This report and additional analytical tools, techniques, and data can be found at our Internet web site. Please visit us at <http://tis.eh.doe.gov/web/oeaf>.



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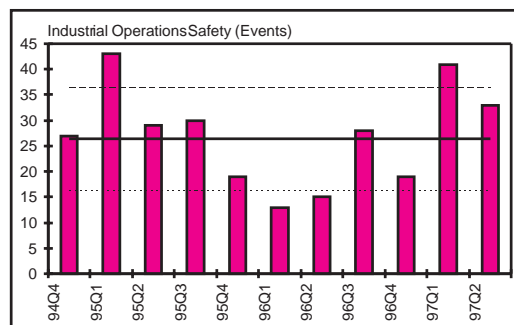
Phone: 301-903-8371
e-mail: richard.day@eh.doe.gov

On the Web

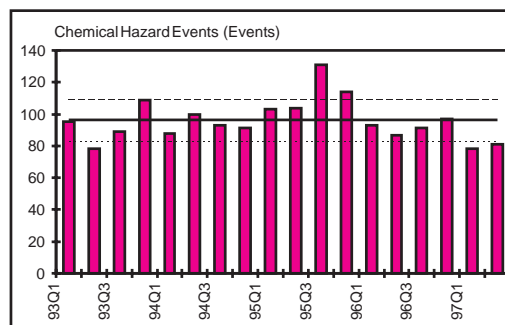
**Contact for Additional
Information**

Management Summary

Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. The horizontal lines on the graphs represent the historical baseline ± 1 standard deviation. Quarterly data is presented as calendar quarters.



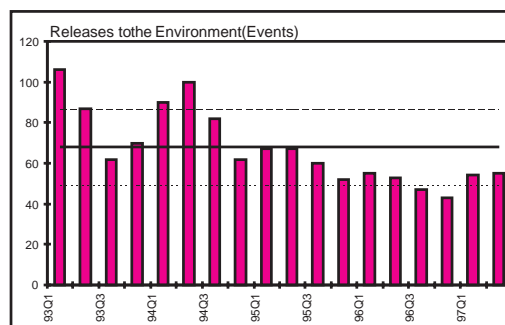
The number of operations-related events involving construction equipment, machining operations, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations*.



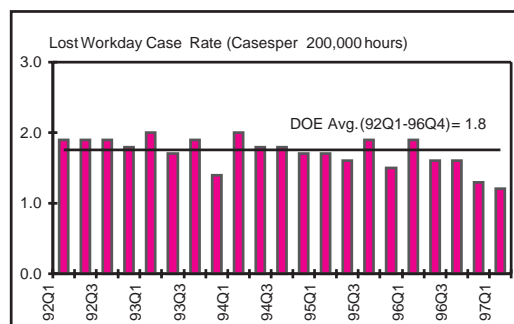
The number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



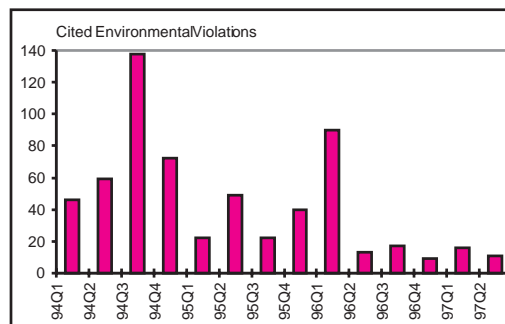
A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain.



Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



Number of environmental violations cited in enforcement actions by regulators at DOE facilities.

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List of Performance Indicators

The performance indicators are organized into four major categories. The numbers correspond to the section numbers used in this report.

Accidents/Events that have already happened

Injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Chemical Hazard Events
6. Reportable Occurrences of Releases to the Environment
7. Cited Environmental Violations
8. Environmental Permit Exceedances
9. Price-Anderson Amendments Act Enforcement
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events

Precursors to accidents and near misses

Events which resulted in significant reduction of barriers that are depended upon for safety.

13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
15. Safety System Actuations
16. Safety Equipment Degradation

ES&H Management

Includes work planning, training, manager and worker involvement, and regulatory compliance.

17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations
19. Enhanced Work Planning Implementation

Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

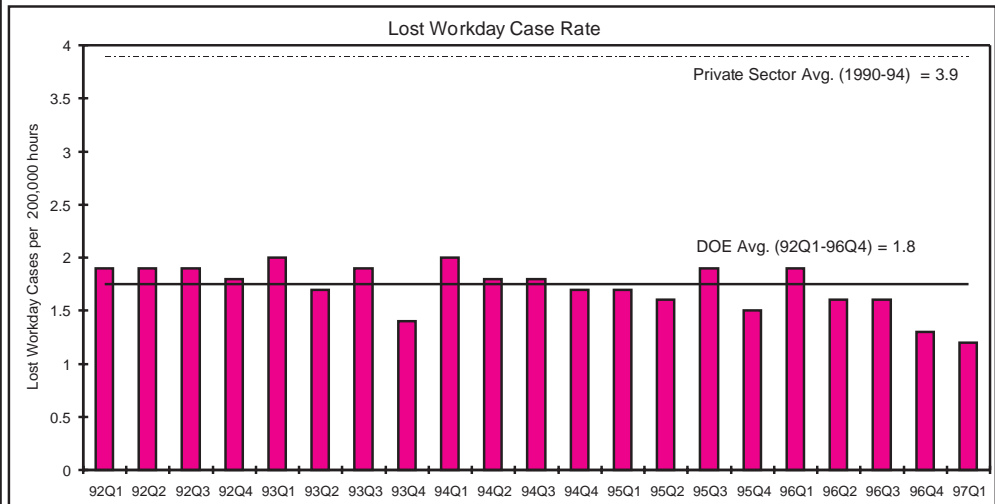
20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
21. Plutonium Stabilization
22. Waste Generation
23. HEU Vulnerabilities Resolved

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Indicator**1. Lost Workday Case Rate****Definition**

A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



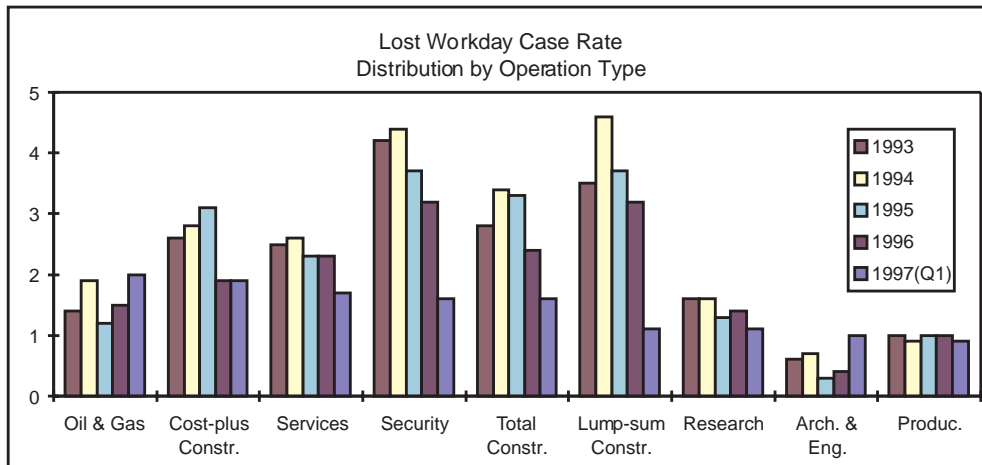
Source: DOE Data - Computerized Accident/Incident Reporting System; Private Sector Data - Department of Labor, Bureau of Labor Statistics.

Key Observations

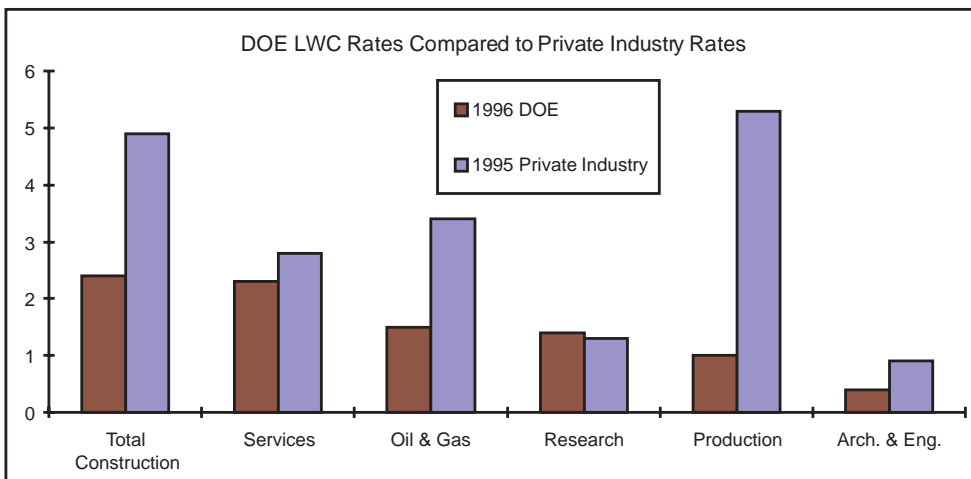
- The preliminary estimate for the 97Q1 LWC rate, 1.2 cases per 200,000 hours worked, fell below the average (92Q1-96Q4) of 1.8 cases per 200,000 hours worked. The 97Q1 rate is the lowest quarterly rate since the current data collection system began in 1990 and is 37% lower than the 96Q1 rate.
- In 97Q1, about 40% of all lost/restricted workday cases reported (392 cases) were serious enough to require days away from work. The remaining 60% resulted in restricted work activity but no days away from work. DOE-wide, the average number of lost workdays per case was 15 days for 97Q1 compared to 30 days for 96Q1.

Additional Analysis

- 45% of all injury/illness cases required days off from work.
- The following graph shows a comparison of the 97Q1 LWC rate distributed by operation type compared to the past four years. The top two contributors (oil and gas and cost-plus construction) reported 97Q1 LWC rates above the 92Q1-96Q4 DOE-wide average rate of 1.8 per 200,000 hours worked.



- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications, including general building construction, manufacturing of chemicals and allied products, oil and gas extraction, research, security, and sanitary services. The graph shows a comparison of 1996 DOE LWC rates with 1995 private industry rates (the most recent BLS survey).



- The Office of the Inspector General (IG) recently released a report on the processes used by three DOE contractors to record and report occupational injuries and illnesses. Based on the findings from this evaluation, the IG recommended several actions to validate current processes and to ensure consistency in the data reported. Following implementation of these actions, the Department will be in a better position to identify organizations with record keeping and reporting problems and what impact, if any, under or over reporting have had on overall statistics.

Indicator**2. Occupational Safety and Health Cost Index****Definition**

In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total work force. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The Index is computed as follows:

$$\text{Cost Index} = 100[(1,000,000)D + (500,000)T + (2,000)LWC + (1,000)WDL + (400)WDLR + (2,000)NFC] / \text{HRS}$$

where

D = the number of deaths,

T = the number of permanent transfers or terminations due to occupational illness or injury,

LWC = the number of lost workday cases,

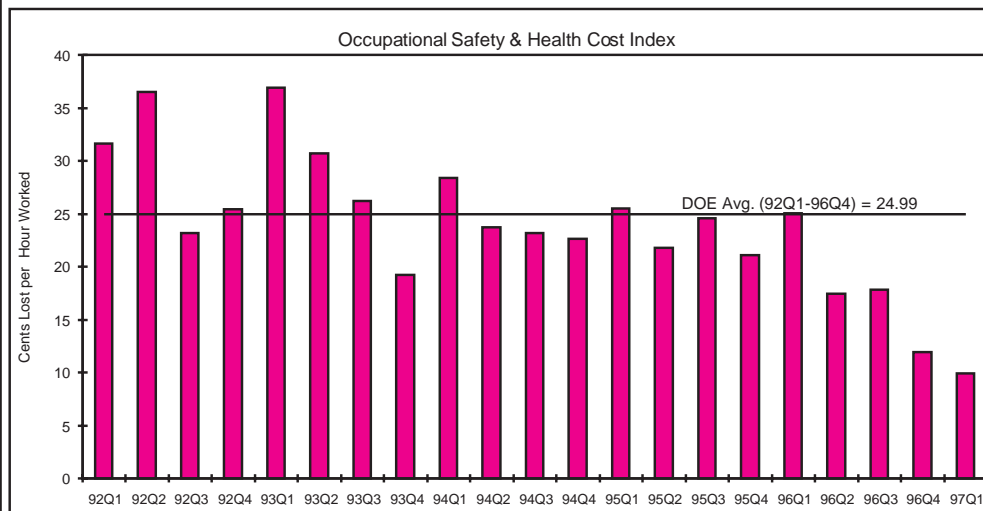
WDL = the number of days away from work,

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.

The coefficients are weighting factors which were derived from a study of the direct and indirect dollar costs of injuries.



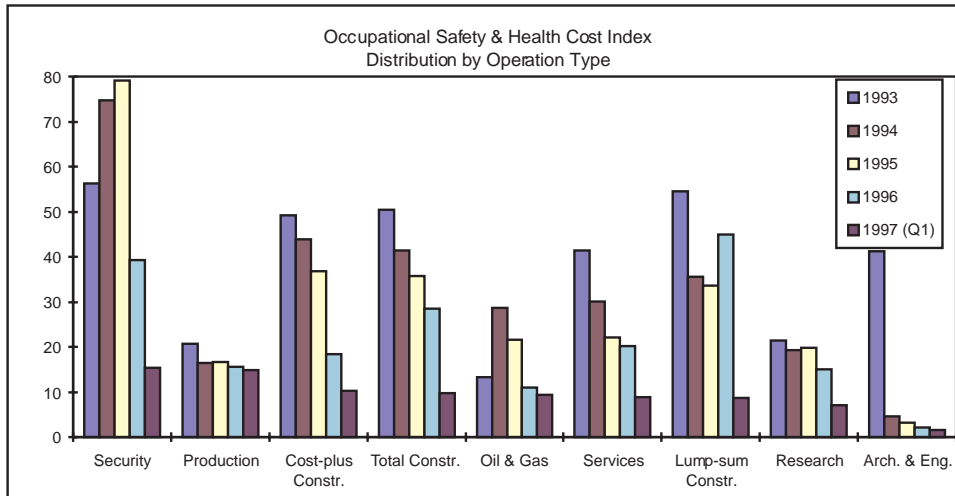
Source: Computerized Accident/Incident Reporting System.

Key Observations

- The Cost Index for each quarter since 96Q2 fell below the average (92Q1-96Q4) of 24.99.
- In 97Q1, the Cost Index continued to decline to the lowest quarterly Index recorded (9.9) since the current data collection system began in 1990. Revisions and late reporting are expected to result in increases in 97Q1 estimates.

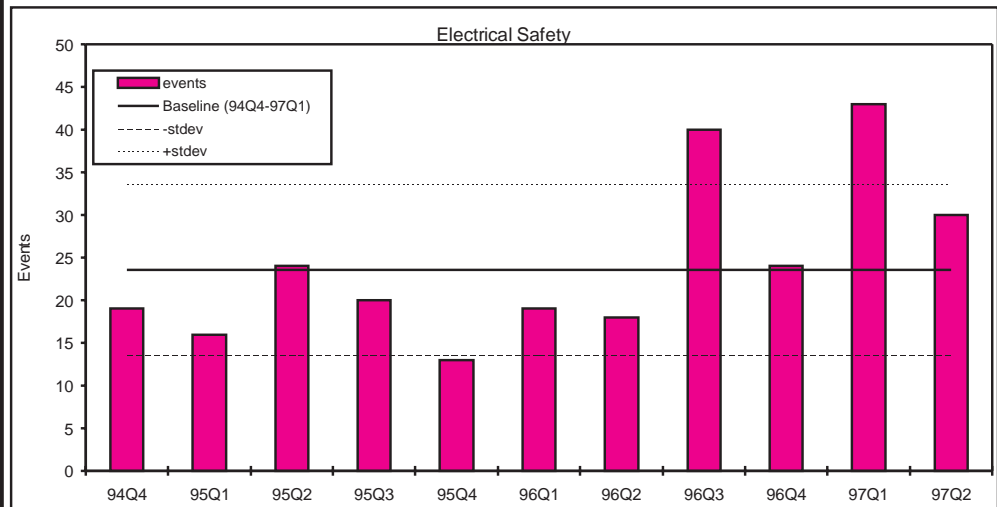
- The following graph shows a comparison of the 97Q1 Cost Index distributed by operation type with the past four years. Preliminary estimates indicate that the 97Q1 Cost Index for all operation types declined below the 1996 level. Operations involving security and production activities reported the highest Index for 97Q1, 15.37 and 14.85, respectively.

Additional Analysis



Indicator 3. Electrical Safety

Definition The number of events involving worker contact or the potential for contact with electrically energized equipment. These events are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



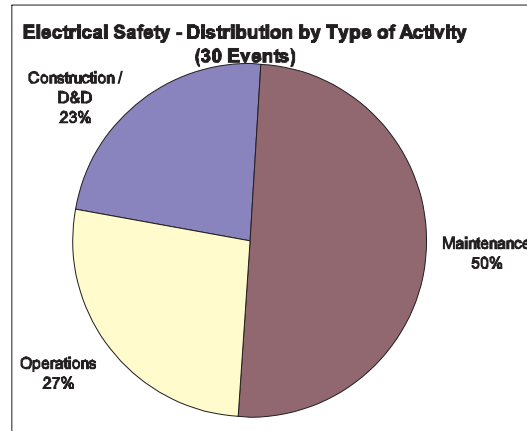
Source: Review of Occurrence Reports by Department analysts.

- Key Observations**
- Of the 30 events in 97Q2, only 7 events involved a person actually receiving a shock. There were no serious shock events requiring hospitalization.
 - The reduction in events from 43 in 97Q1 to 30 in 97Q2 is largely due to a smaller number of events being reported from two field offices, Hanford and Albuquerque.

- Additional Analysis**
- For the second consecutive quarter there have been no serious injuries from electrical accidents.
 - In 97Q1, 35 of the 40 root causes identified are in personnel error and management problems. An aggregation of root causes in these two areas could indicate a need for improved training.

Distribution by Activity

- The 30 electrical safety events in 97Q2 fall into 3 major categories: construction (including decontamination/decommissioning activities), maintenance activities, and routine operations. In 97Q2 there were fewer construction-related events (down from 18 in 97Q1 to 7 in 97Q2). This reduction in construction-related events does not appear attributable to any particular site.

**Distribution by Location**

- The number of events (30) are evenly distributed among 14 sites with no site reporting more than 6 events and most sites reporting either 2 or 3 events.

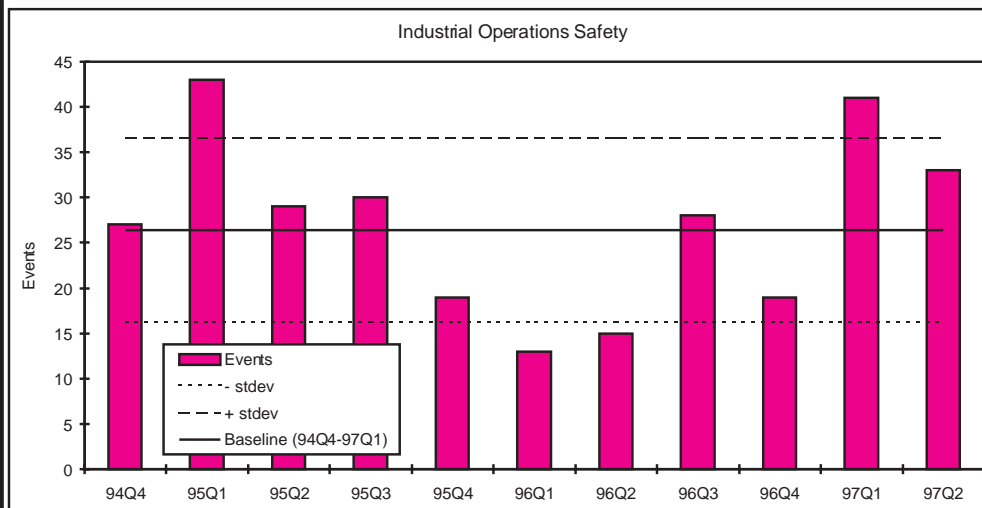
Distribution by PSO

- Half of the events reported in 97Q2 took place in facilities under the responsibility of the Office of Environmental Management (EM). The percentage of these events at EM facilities (as compared to the total number of these events at DOE facilities) is essentially unchanged from 97Q1.



Indicator**Definition****4. Industrial Operations Safety**

The number of operations-related events involving construction equipment, machining operations, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department analysts.

Key Observations

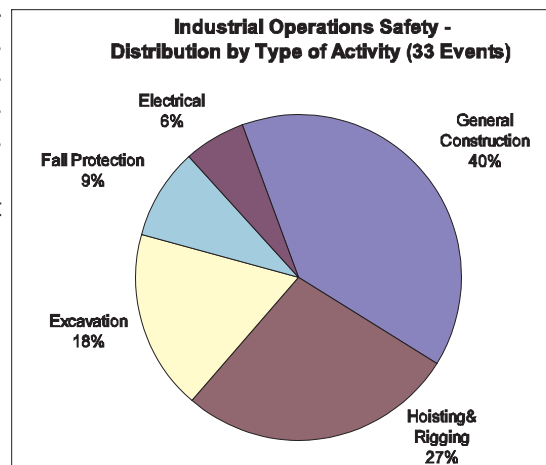
- Industrial operations safety related events decreased from 40 occurrences in 97Q1 to 33 in 97Q2.

Additional Analysis

- A total of 4 industrial operations-related injuries were reported, including a fatality at Brookhaven National Laboratory. In this case, two construction workers were working on a sewer line replacement project in a remote area east of a recharge basin. One worker was operating a front-end loader while the second worker was setting the grade with a leveling stick. The individual operating the front-end loader ran over the worker who was setting the grade.

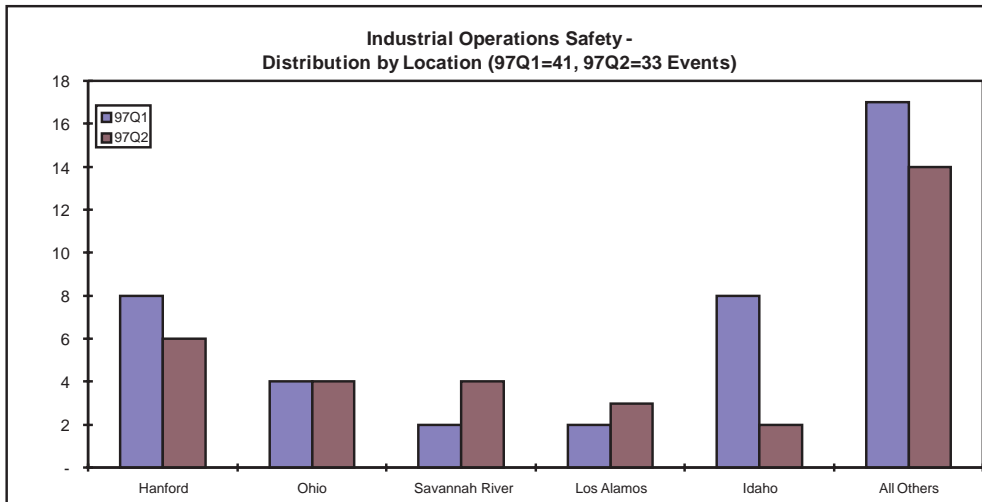
Distribution by Activity

- During 97Q2, excavation and hoisting and rigging activities contributed to 45% of all industrial operations safety-related incidents. General construction activities contributed another 40%. A detailed breakdown is shown in the graph at right.

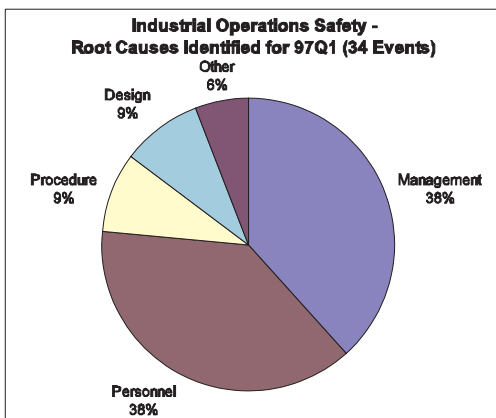


Distribution by Location

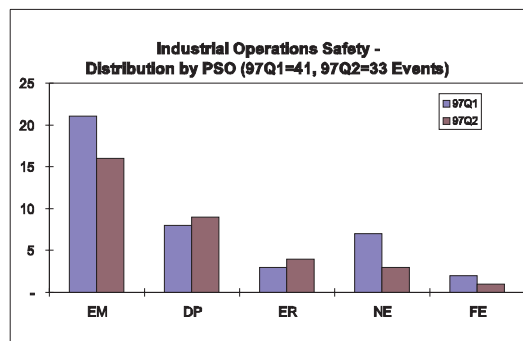
- Distribution by location is shown in the following graph. A comparison with 97Q1 is also provided. Idaho's contribution decreased significantly from 8 events in 97Q1 to 2 events in 97Q2.

**Distribution by Root Cause**

- Root causes were identified for 34 of the 41 occurrences in 97Q1. They are distributed as shown in the following graph.

**Distribution by PSO**

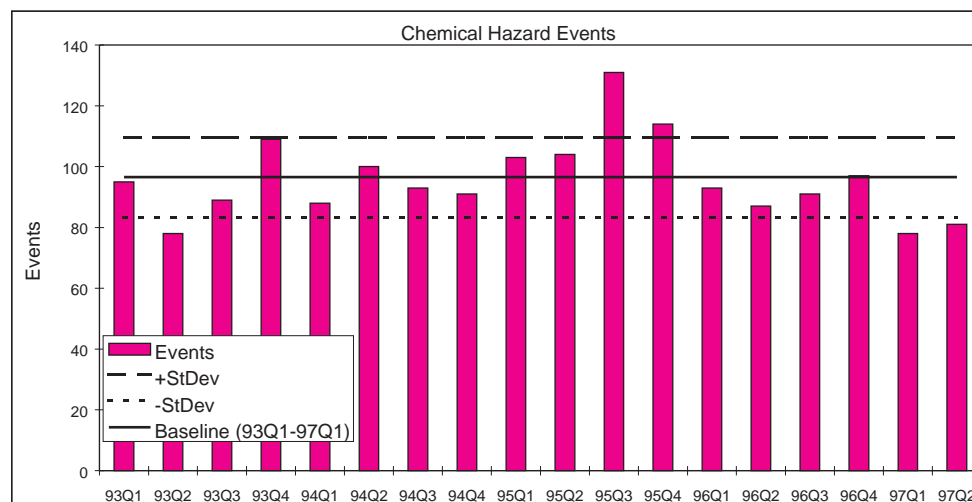
- Distribution by Program Secretarial Offices (PSO) is shown in the chart. Environmental Management was responsible for 48% of all industrial operations safety-related events in 97Q2.



Indicator 5. Chemical Hazard Events**Definition**

The number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

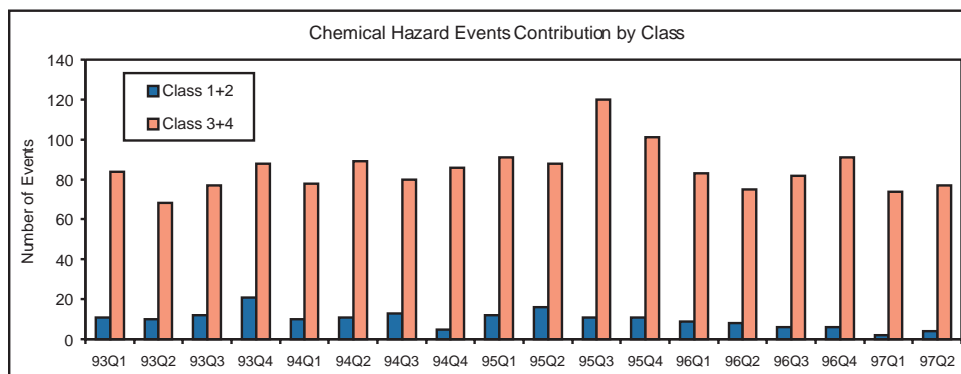
- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases which are significant by the frequency, but not by the consequences.



Source: *Chemical Safety Concerns: A Quarterly Review of ORPS October-December 1996*. US Department of Energy, Office of Field Support, EH-53 (draft as of 1-23-97). World Wide Web at: <http://www.dne.bnl.gov/etd/csc/>

Key Observations

- There was a modest increase in the number of chemical hazard events in 97Q2; however, the number of events (81) remains well below the average (93Q1-97Q1) of 96.5. Since 95Q3, there is a decreasing trend in the number of chemical hazard events.
- Class 1 and 2 events have decreased significantly over the past two years. There were 6 Class 1 and 2 events reported in the first half of 1997 compared to 29 in 1996. Over the past 18 quarters (93Q1-97Q2), there is a decreasing trend in the number of Class 1 and 2 events.



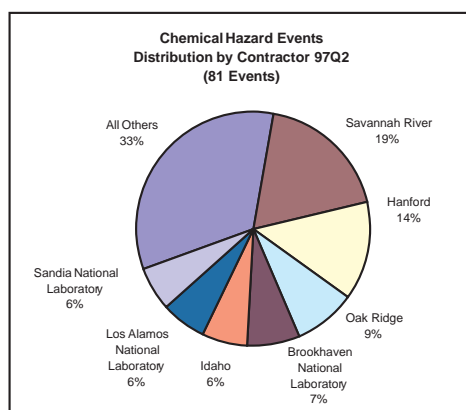
Characterization of Chemical Hazard Events

- During 97Q2, one Class 1 event and three Class 2 events were identified. The Class 1 event occurred in the Plutonium Reclamation Facility (PRF) at Hanford's Plutonium Finishing Plant (PFP) and involved the explosion of legacy chemicals. One Class 2 event involved "rapid over-pressurization" of a waste chemical container at Fernald; one Class 2 event involved employee exposure to dielectric fluid at Rocky Flats; and one Class 2 event involved the discovery of a chemical that became unstable due to refrigeration at Lawrence Livermore National Laboratory (LLNL).

Additional Analysis

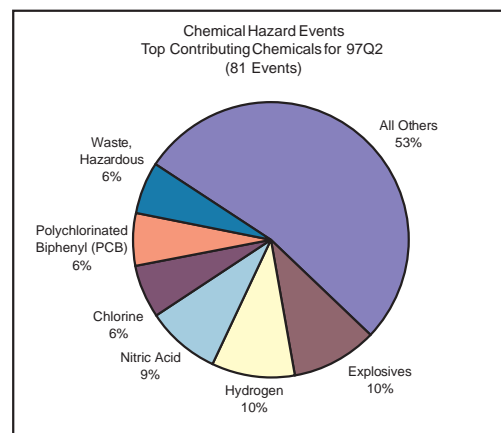
Distribution by Location

- The major contributors to chemical hazard events in 97Q2 are identified in the chart. Savannah River and Hanford continue to be the top two contributors, accounting for 31% of the events in 97Q2. There is a decreasing trend in the number of chemical hazard events observed at Savannah River since 95Q3. Since 96Q2, there is an increasing trend in the number of events at Hanford.



Distribution by Chemicals Involved

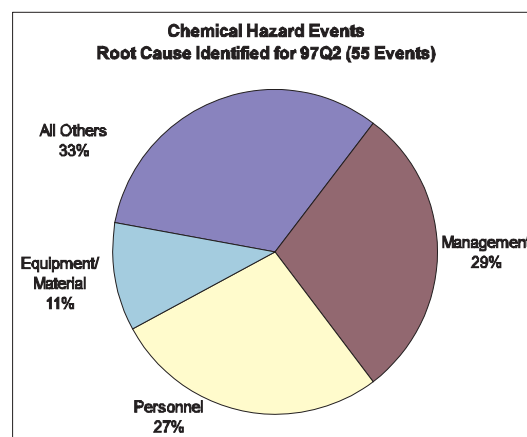
- The chemicals most often involved in chemical hazard events (i.e., top contributing chemicals) during 97Q2 are identified in the chart. High explosives, hydrogen, and nitric acid were the leading contributors. High explosive events took place largely at Pantex and LLNL. Hydrogen and nitric acid events occurred primarily at Savannah River.



- UF₆ was involved in only 1 chemical hazard event identified during 97Q2. Chemical hazard events involving UF₆ have decreased since 95Q4, corresponding with the implementation of an agreement that United States Enrichment Corporation (USEC) no longer is required to report off-normal events to DOE.

Distribution by Root Cause

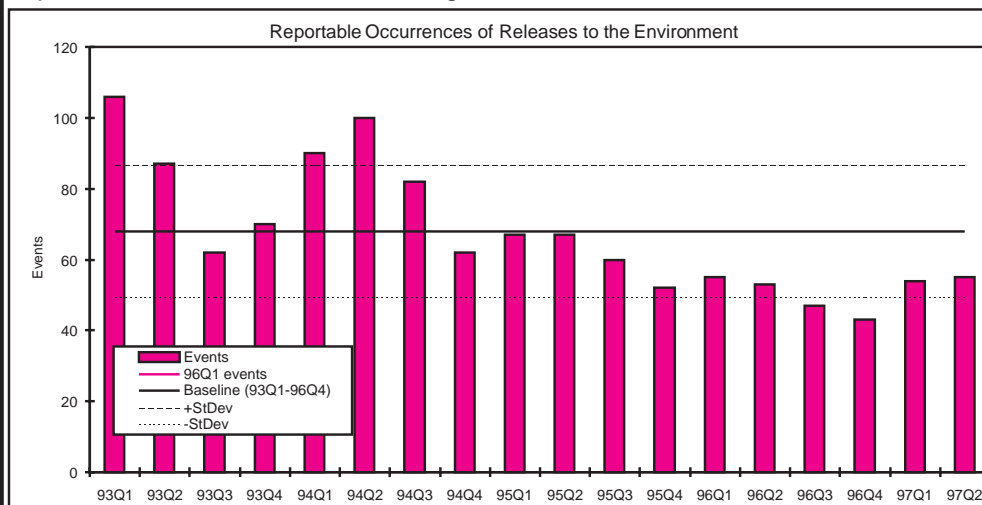
- The root cause distribution for 97Q2 is shown in the chart for those events in which a root cause has been identified. 56% of root causes identified were management problems or personnel errors.



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Indicator 6. Reportable Occurrences of Releases to the Environment

Definition Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



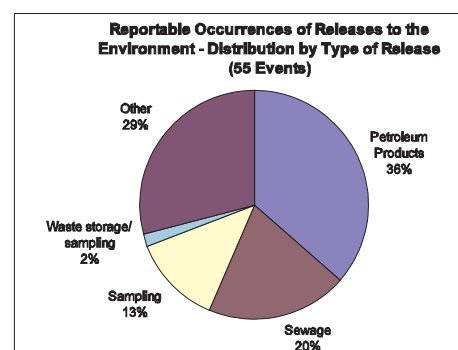
Source: Review of Occurrence Reports by Department analysts.

Key Observations • The data continue to show a downward trend over the past 15 quarters.

Additional Analysis • Two significant events were reported during 97Q2 which received significant media attention. The first was an explosion at the Plutonium Reclamation Facility at Hanford which caused significant localized damage to the facility. No employees were injured and no radioactive materials were released to the environment. The second event was that tritium was unexpectedly found in a groundwater monitoring well at Brookhaven National Laboratory.

Distribution by Type of Release

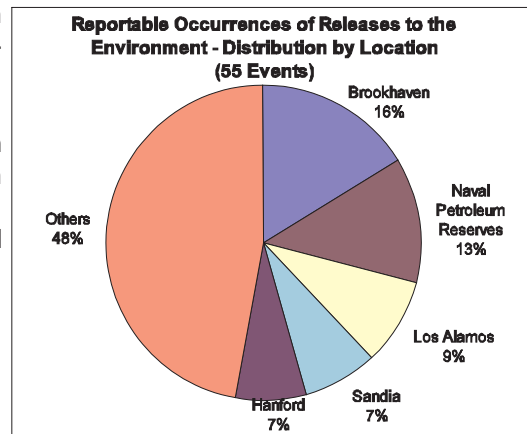
• Various types of releases for 97Q2 are shown in the graph. Petroleum products remain the predominant source of events. 7 of the 20 petroleum events occurred at the Naval Petroleum Reserve. The total amount of oil spilled in 97Q2 by the Naval Petroleum Reserve was 358 barrels, of which 339 barrels (95%) were recovered. The remaining petroleum events were due to leaking oil and hydraulic fluid lines and damaged containers.



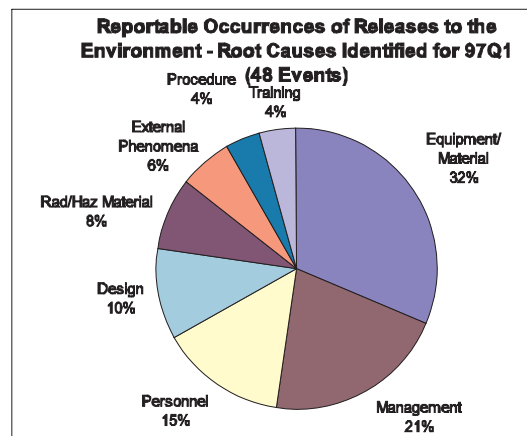
Distribution by Location

- During 97Q2, only 5 locations reported more than 3 events.

- Reportable events at Brookhaven National Laboratory continued to increase from 1 in 96Q4 to 7 in 97Q1 and, subsequently, to 9 in 97Q2. The events included tritium found in the groundwater, a transmission fluid spill, two transformer leaks, one contained chemical spill, and three events involving oil.

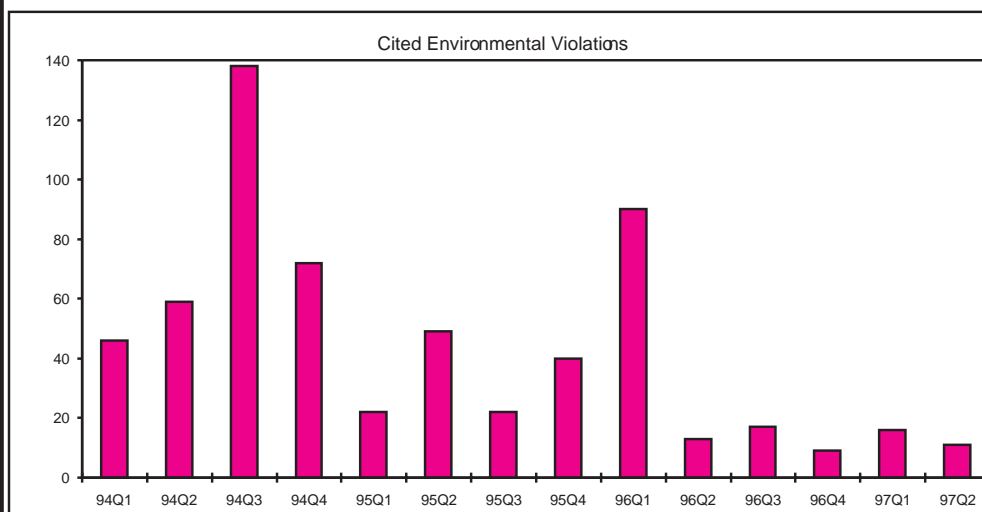
**Distribution by Root Cause**

- In 97Q1, the leading root cause identified for release events continues to be the equipment/material category.



Indicator 7. Cited Environmental Violations

Definition Number of environmental violations cited in enforcement actions by regulators at DOE facilities.



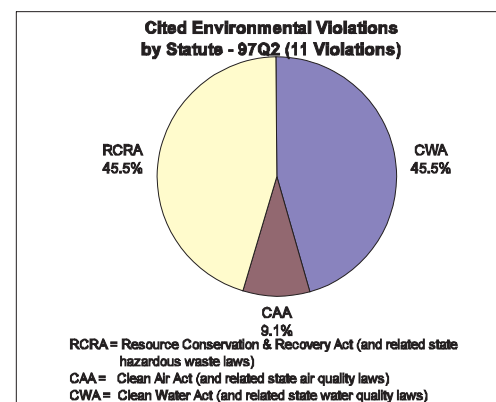
Source: EH-41 Compliance Database

- Key Observations**
- Nearly half the violations cited in 97Q2 (5 of 11) stem from self-reported exceedances of water discharge permit levels.

- Additional Analysis**
- The majority of the violations are related to the following statutes:
 - Resource Conservation and Recovery Act (RCRA),
 - Clean Air Act (CAA),
 - Clean Water Act (CWA), and
 - Toxic Substances Control Act (TSCA).

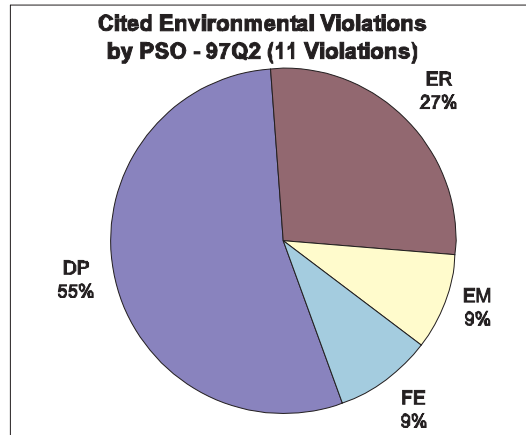
Violations by Statute

- CWA accounts for almost half the cited violations in 97Q2. (In past quarters RCRA has consistently accounted for about three-quarters of the cited violations.)



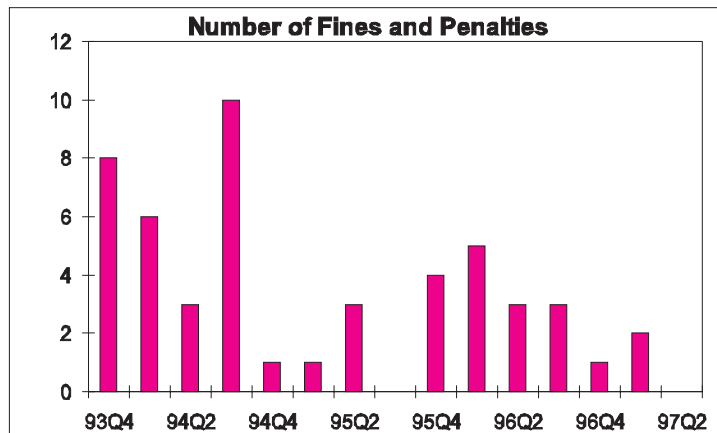
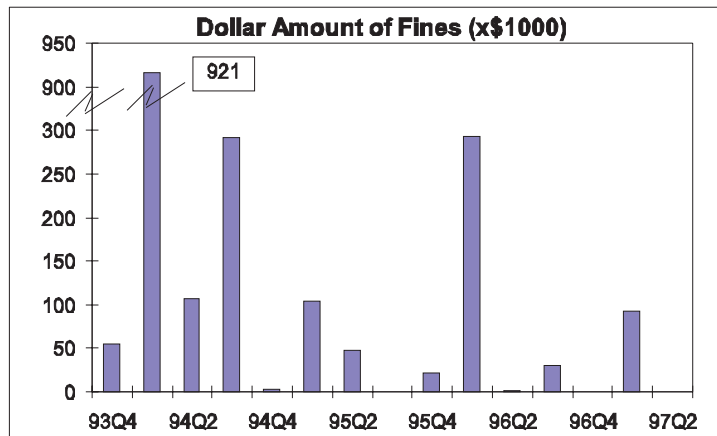
Violations by Program Office

- A majority of the violations cited in 97Q2 were for activities under the Office of Defense Programs (DP).



Amount of Fines and Number of Fines

- No fines were assessed during 97Q2.

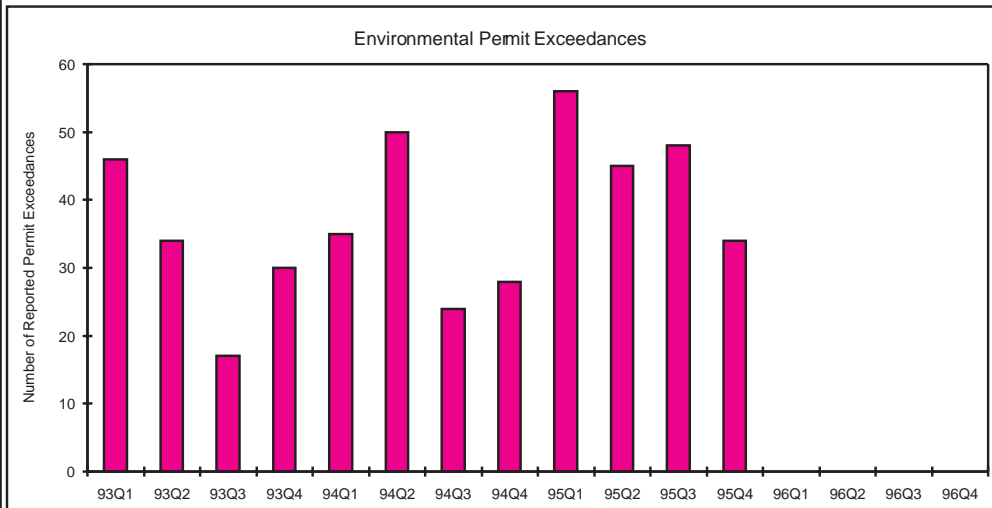


Indicator**Definition**

No changes to this section since last report.

8. Environmental Permit Exceedances

Exceedance of release levels specified in air and water permits during the quarter.



Source: Annual Site Environmental Reports, additional site data.

Key Observations

- The number of permit exceedances has increased each year from 1993 through 1995.
- In 1995, as in previous years, the great majority (94%) of exceedances are due to violations of permits under the Clean Water Act for discharge to surface waters.
- A few sites account for the majority of DOE's permit exceedances. In 1995, six sites accounted for more than half of the permit exceedances. From 1993 through 1995, five facilities accounted for more than half of the permit exceedances.

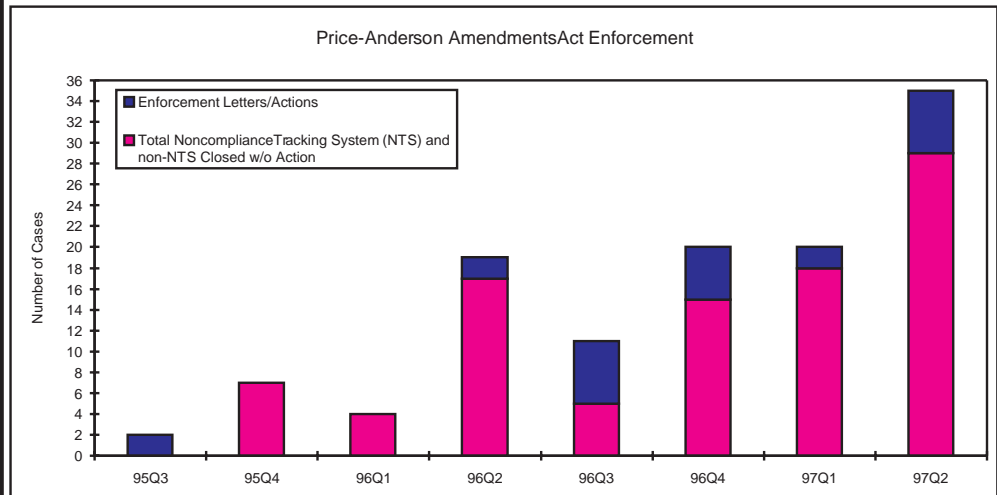
Additional Analysis

- Most exceedances (94%) continue to occur under National or State Pollution Discharge Elimination System Permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc.
- Other permit exceedances occurred under Clean Air Act permits (3%) and ground-water discharge permits (3%).
- Over the 3-year period 1993-1995, 5 sites accounted for more than half of the exceedances, and 9 sites accounted for 70% of the exceedances. In 1995, 6 sites (although not the identical list) accounted for more than half of the permit exceedances.
- Six sites had exceedances in at least 10 of the 12 quarters reported; however, two of these sites showed significantly fewer exceedances than in the previous two years.

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Indicator**9. Price-Anderson Amendments Act Enforcement****Definition**

Total number of cases the Price-Anderson Amendments Act^a (PAAA) Enforcement Office reviews per quarter.



Source: Office of Enforcement and Investigation database.

Key Observations

- The number of cases the PAAA Enforcement Office reviewed quarterly has steadily increased since the office began enforcement action. This increase is due to completion of the enforcement program infrastructure development which included establishing noncompliance reporting systems, issuing guidance documents, conducting training, and disseminating information.

Additional Analysis

- Three Enforcement Letters and three Preliminary Notices of Violation (PNOV) were issued in 97Q2. DOE weighs several issues when deciding to issue a PNOV with a civil penalty or when considering the amount of the civil penalty: (1) the safety significance of the noncompliance, (2) initiative by the contractor in identifying and reporting the noncompliance, and (3) the timeliness and effectiveness of corrective actions.
- There were no civil penalties imposed for the three issued PNOV's as of the end of 97Q2.
- Of the 29 cases reviewed and closed without action by the PAAA Enforcement Office in 97Q2, 10 items were identified in the Noncompliance Tracking System and 19 were identified independently.

Reference

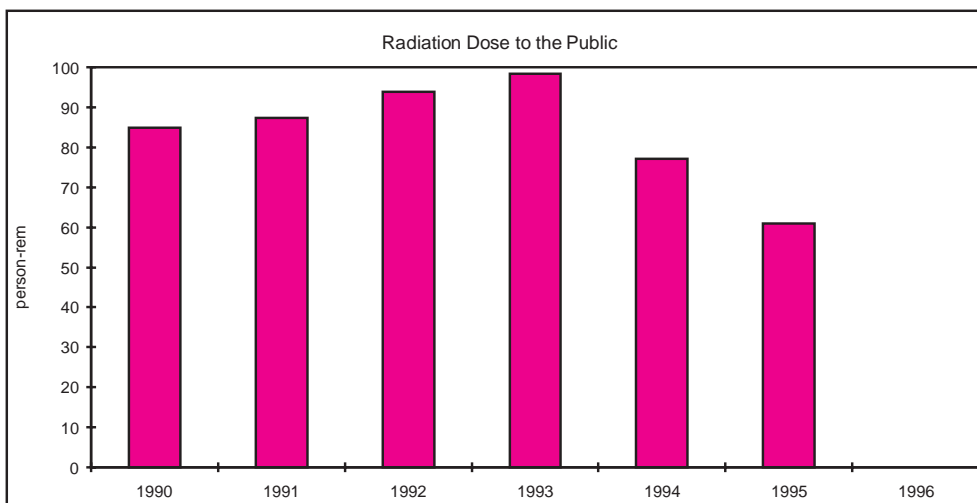
^a 10 CFR Parts 830.120, 835 and 820.11.

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Indicator 10. Radiation Dose to the Public

Definition Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)

No changes to this section since last report.



Source: Annual reports to EPA; EH-41 preliminary tabulation.

Key Observations

- Total collective radiation dose to the public from DOE sources is very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases is one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1995 decreased 21% from the previous year.
- Based on corrected data, total collective radiation dose to the public decreased 22% from 1993 to 1994.
- The decrease in collective radiation dose in 1995 reflects decreases in the dose from Oak Ridge, Lawrence Livermore Site 300, and Savannah River; in 1994 these sites accounted for almost 68% of the dose.

Additional Analysis

- In 1994, Oak Ridge, Lawrence Livermore Site 300, and Savannah River accounted for almost 68% of the total dose.
 - In 1995, the dose from Savannah River was 22% the dose reported in 1994, a decrease of 12.5 person-rem. The reduction was due to operational changes at the Replacement Tritium Facility (RTF). The RTF had decreases in tritium oxide emissions and decreases in tritium processing.
 - In 1995, the dose from Lawrence Livermore Site 300 was 45% the dose reported in 1994, a decrease of 9.3 person-rem. The reduction reflects a lower level of operation at the Building 513 Stabilization Unit.

- In 1995, the dose from the Oak Ridge Reservation was 63% the dose reported in 1994, a decrease of 7 person-rem. The reduction is due to operational changes at the Y-12 plant.
- While the dose from several other sites increased from 1994 to 1995, there was still a net decrease of 21% below the 1994 population dose.
- An increase of 7.8 person-rem in the calculated dose from Lawrence Berkeley National Laboratory appears to reflect the use of local wind data for 1995 instead of Oakland Airport data as in previous years.

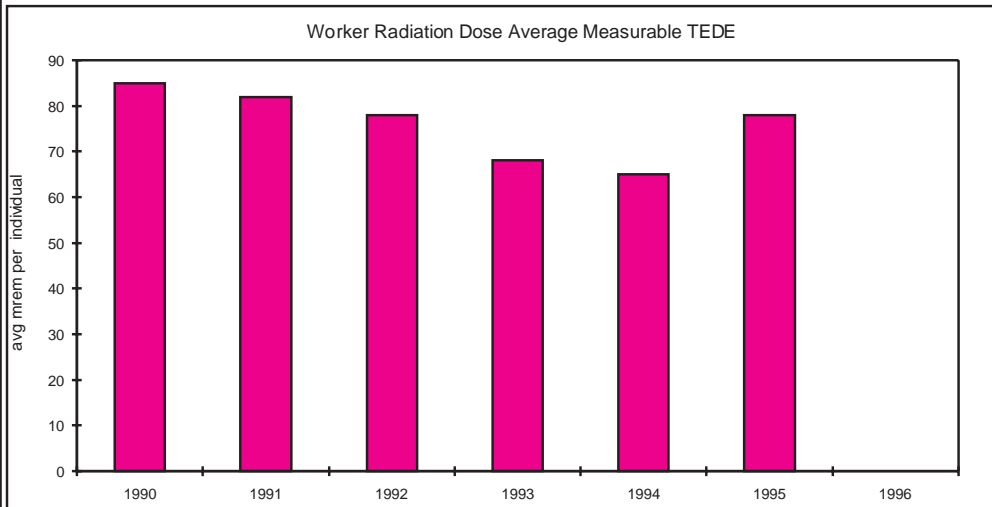
Indicator**Definition**

No changes to this section since last report.

11. Worker Radiation Dose

The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed work force size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.



Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1995, DOE/EH-52, U.S. Department of Energy, December 1996 draft.

Key Observations

- The average TEDE per individual with measurable exposure decreased from 85 mrem in 1990 to 78 mrem in 1995. For comparison, the average exposure for the U.S. population from medical diagnostic x-rays is about 40 mrem.^a
- For the first time in six years, average radiation dose per person is increasing. A good portion of this increase in 1995 is attributed to increased decontamination and decommissioning work.
- 80% of the collective TEDE is accrued at just six of the highest-dose DOE sites: Savannah River, Rocky Flats, Hanford, Los Alamos, Idaho, and Brookhaven.
- Occupational radiation dose reported by DOE has been impacted over the past 5 years by changes in operational status of DOE facilities, reporting requirements, and radiation protection standards and practices.

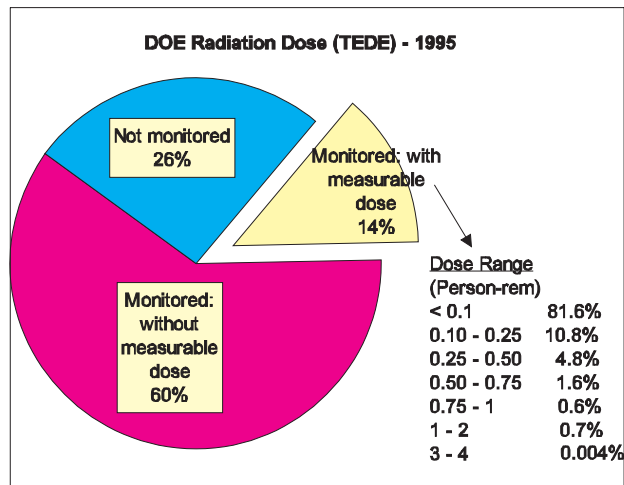
Additional Analysis

- Additional information concerning exposure received by individuals associated with DOE activities is included in the DOE Occupational Radiation Exposure Report 1995 (December 1996 draft).

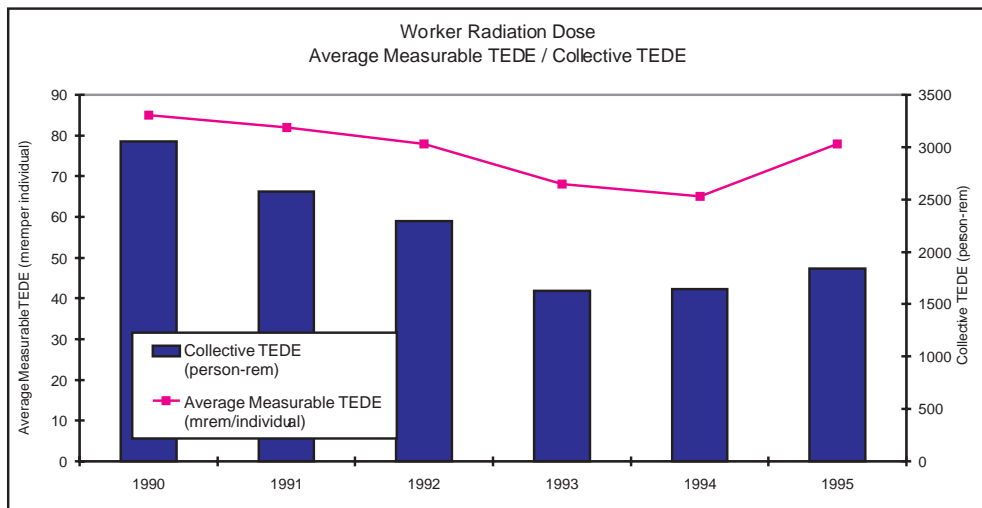
DOE Doses

- In 1995, 74% of the 172,178 DOE workers and contractors were monitored; 19% of those monitored received a measurable dose.

- No individuals exceeded the DOE TEDE limit of 5 rem. 92% of the workers with a measurable dose received a dose of less than 0.25 rem. Doses in excess of the ACL and the DOE TEDE dose limit have decreased over the past 6 years. Most of this decrease is because of the change in methodology for determining internal dose discussed below.



- The collective TEDE (the sum of the TEDE received by all monitored individuals) for 1995 was 1840 person-rem. The graph below indicates the decline in both average dose and collective dose.

**Distribution by Site**

- The six leading contributors to the collective TEDE for 1995 comprised 80% of the total DOE dose. Five of the six sites reported increases which resulted in a 12% increase in the DOE collective dose from 1994 to 1995. The sites provided the following information on activities that contributed to the collective dose for 1995.
 - Los Alamos: Most of the 24% increase (from 190 to 235 person-rem) was attributed to increased work on the production of power sources for NASA.
 - Brookhaven: Most of the 58% increase (from 92 to 146 person-rem) is attributed to an 82% increase in the days of operation and intensity of the Alternating Gradient Synchrotron accelerator. Increased frequency of maintenance surveys conducted on aging equipment was also a contributing factor.

- Idaho: Most of the 20% increase (from 237 to 284 person-rem) is attributed to increased operations at Idaho Chemical Processing Plant (ICPP). Two key ICPP facilities were deactivated in 1995.
- Rocky Flats: Most of the 12% increase (from 232 to 261 person-rem) is attributed to increased decontamination/decommissioning activities and material stabilization work. Consolidation of special nuclear material and processing of potentially unstable residues for safe storage began in 1995.
- Hanford: Most of the 35% increase (from 215 to 291 person-rem) is attributed to increased use of the tank farm and K Basins associated with nuclear material and facility stabilization.
- Savannah River: The site collective TEDE decreased 19% from 1994 to 1995 (from 315 to 256 person-rem). Operations at the major facilities were about the same in 1995 as in 1994. The Defense Waste Processing Facility (which represented 5% of Savannah River's total in 1994) was restarted near the end of 1995.

Comparison to Other Sources

- Table 1 provides 1995 average occupational exposures for workers with measurable doses for Nuclear Regulatory Commission licensees.

TABLE 1
Comparison to 1995 Average Occupational Exposures for Workers with Measurable Doses^b

License Category	Average Measurable TEDE per Worker (rem)
Industrial Radiography	0.54
Manufacturing and Distribution	0.49
Low-level Waste Disposal	0.14
Independent Spent Fuel Storage	1.04
Fuel Fabrication and Processing	0.43
Commercial Light Water Reactors	0.31

- The average radiation worker dose received from DOE operations in 1995 was 78 mrem per individual. This should be contrasted to background radiation levels of 27 mrem per individual from cosmic radiation, 28 mrem per individual from terrestrial sources, and 200 mrem from naturally occurring radon sources.^c

Changes Impacting DOE Occupational Radiation Dose

- Change in operational status of facilities is the predominant driver behind changes in the collective dose. Significant reductions in the opportunities for individuals to be exposed occur as facilities are shut down and transitioned from operation to stabilization or decommissioning and decontamination.
- Changes to reporting requirements have significantly impacted the collective dose at DOE. The change in internal dose methodology from annual effective dose equivalent (AEDE) to committed effective dose equivalent (CEDE) between 1992 and 1993 resulted in a reduction of the collective TEDE by 28%, because the dose from prior intakes is no longer reported.

- Radiation protection practices have changed because of the implementation of the Radiological Control Manual (RadCon Manual). The RadCon Manual changed the methodology to determine internal dose, established Administrative Control Levels (ACL), standardized radiation protection programs, and formalized "As Low As Reasonably Achievable" (ALARA) practices.

References

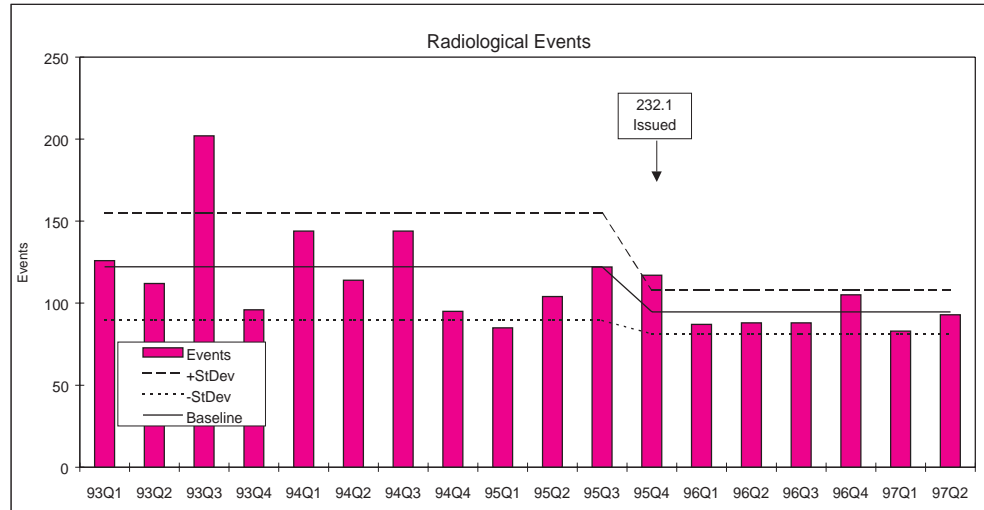
^a *Exposure of the U.S. Population from Diagnostic Medical Radiation*, National Council on Radiation Protection and Measurements, NCRP Report No. 100, Bethesda, MD, May 1989.

^b M. L. Thomas, D. Hagemeyer, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1995*, NUREG-0713, Vol. 17, January 1997.

^c Merril Eisenbud, *Environmental Radioactivity from Natural, Industrial and Military Sources*, 3rd Edition, by Academic Press, Inc., 1987.

Indicator 12. Radiological Events

Definition Number of reportable radiological events as defined in DOE Order 232.2, *Occurrence Report and Processing of Operations Information*. These events are made up of both personnel contaminations and radiation exposures which are reported as personnel radiation protection events.



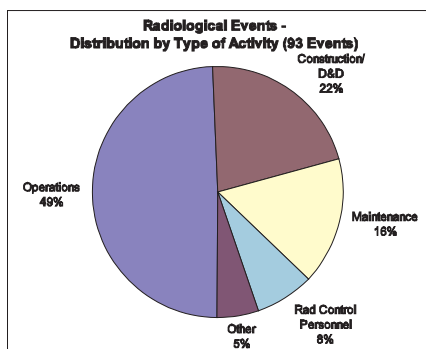
Source: Review of Occurrence Reports by Department analysts.

Key Observations

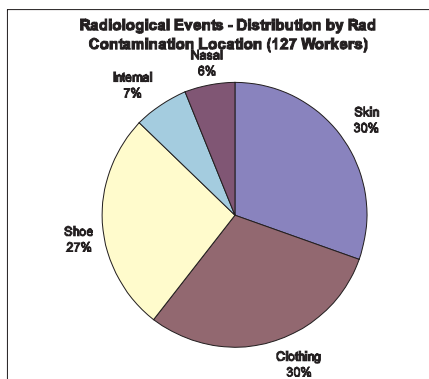
- The number of radiological events has remained relatively constant since the full implementation of DOE Order 232.1 in 96Q1.
- 127 individuals were contaminated in the 93 reported radiological events in 97Q2. This represents an increase in the actual number of personnel contaminated when compared to the previous quarter in which 94 personnel contaminations occurred.
- The number of confirmed internal contaminations continued to increase from 7 in 97Q1 to 10 in 97Q2. In one event a worker received a 50 year CEDE of 17 rem, exceeding the annual federal limit of 5 rem.
- In 5 of the radiological events reported this quarter, the suspected source of the contamination was what was assumed to be clean, contractor-issued clothing from the laundry. This observation warrants further scrutiny to assure radiological control programs are adequate to provide proper protection of the workforce.

Distribution by Activity

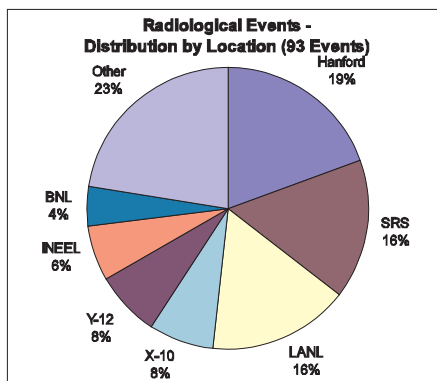
- The events reported in 97Q2 were analyzed as to the type of activity that was taking place at the time of the contamination. The following chart represents this analysis.
- The distribution of events by the type of activity taking place is consistent with that observed in previous quarters.

**Additional Analysis****Distribution by Rad Contamination Location**

- The events reported in 97Q2 were analyzed as to the location on the individual that the contamination occurred. The following chart represents this analysis.
- 45 of the 93 events reported the specific isotope involved in the contamination(s). Of these events, 12 (27%) involved Plutonium 238/239, 8 (18%) involved Cesium 137, 7 (16%) involved Uranium 235/238, 6 (13%) involved Strontium 82, and 5 (11%) involved Cobalt 60.

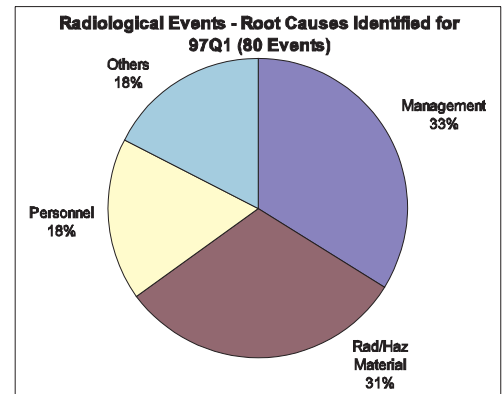
**Distribution by Location**

- The following chart represents the distribution of radiological events for 97Q2 by location.
- The number of radiological contamination events at INEEL decreased significantly from 97Q1 (16) to 97Q2 (6). Per discussions with the field, factors contributing to this decrease included improvements in the ALARA program, increased oversight, and descope work.



Distribution by Root Cause

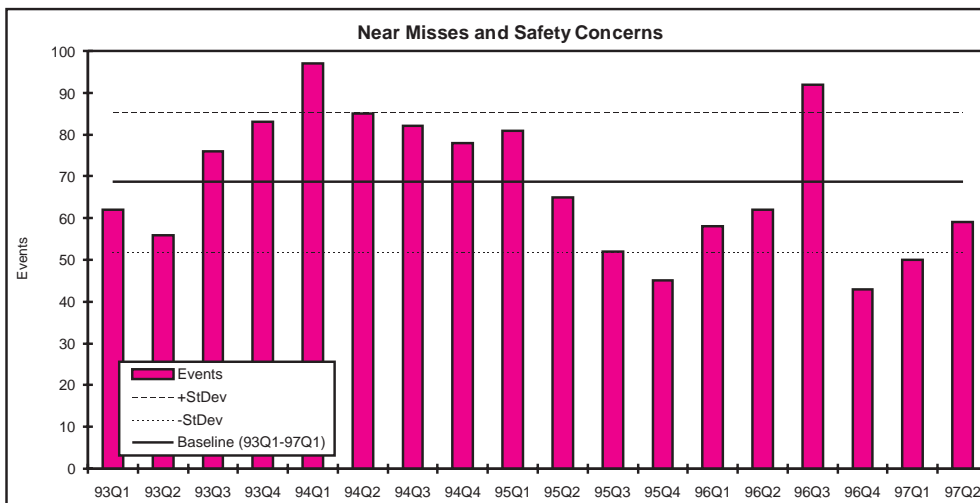
- Of the 83 radiological contamination events reported in 97Q1, 80 had performed a root cause analysis. The following chart represents the distribution of these radiological events by root cause.



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Indicator**13. Near Misses and Safety Concerns****Definition**

A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain (e.g., lack of fall protection, electric shock without injury, unauthorized confined space entry). A safety concern includes: the unauthorized use of hazardous products or processes, or if work is shut down as a result of an OSHA violation. Near misses and safety concerns are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



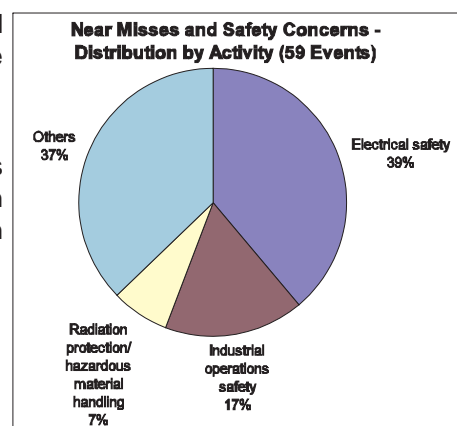
Source: Review of Occurrence Reports by Department analysts.

Key Observations

- The total number of near misses and safety concerns events continued to increase from 50 in 97Q1 to 59 in 97Q2. Again, electrical safety related events contributed the most with 23 events in 97Q2 as compared to 17 in 97Q1 and 12 in 96Q4.
- One emergency event involving an explosion at Hanford's Plutonium Reclamation Facility was reported in 97Q2.

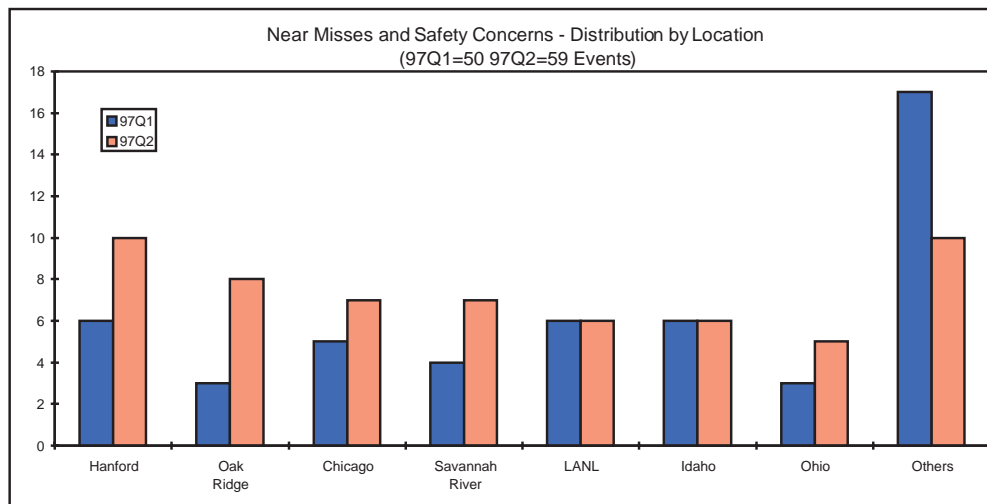
Additional Analysis**Distribution by Activity**

- A detailed breakdown of near misses and safety concerns events distributed by type of activity is shown in the following chart.
- Near misses and safety concerns events resulting from violation of fall protection were reduced from 5 events in 97Q1 to 0 in 97Q2.

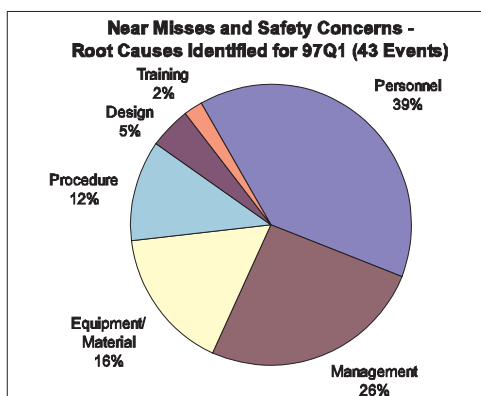


Distribution by Location

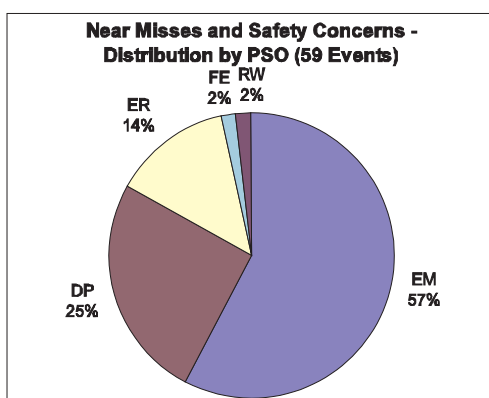
- The distribution of near misses and safety concerns by location is shown in the following chart.

**Distribution by Root Cause**

- Root causes were identified for 43 of the 50 events in 97Q1 for near misses and safety concerns events. They are distributed as shown in the following chart.

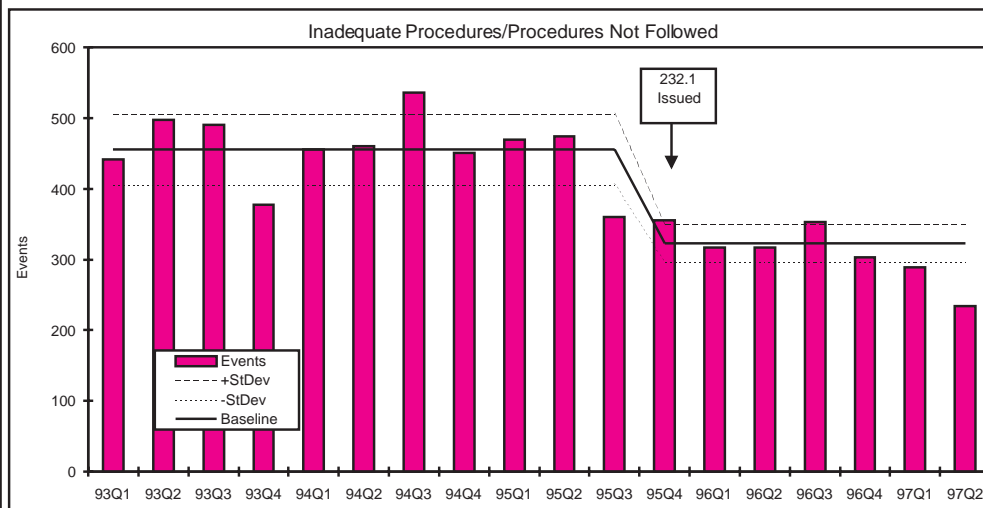
**Distribution by Program Secretarial Offices (PSO)**

- The distribution of near misses and safety concerns by PSO is shown in the following chart.



Indicator 14. Inadequate Procedures/Procedures Not Followed

Definition Number of reportable events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure violations or problems, or which are reported as being caused by a procedure violation or problem.



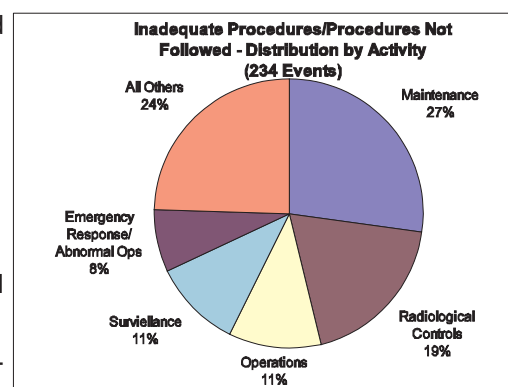
Source: Review of Occurrence Reports by Department analysts.

Key Observations

- A decreasing trend exists since 93Q1. This trend is especially apparent since 94Q4.
- The number of events involving procedure violations or inadequacies in 97Q2 (234) decreased by 15% when compared to the number of events reported in 97Q1 (274).

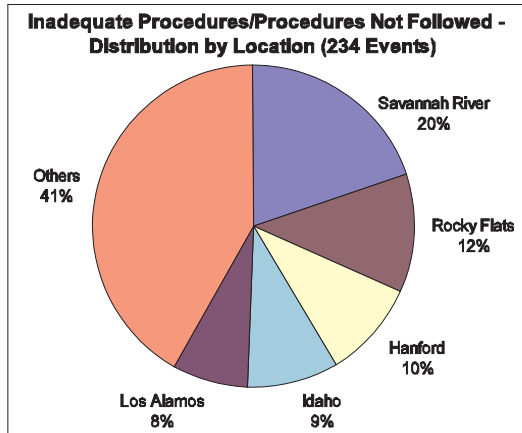
Additional Analysis Distribution by Activity:

- The major types of activities reported during 97Q2 were:
 - Maintenance related (64)
 - Radiological Controls related (44)
 - Operations related (26)
 - Surveillance related (25)
 - Emergency Response / Abnormal Operations related (18).
- Of the maintenance-related activities, the single largest contributor was electrical maintenance.
- Other significant contributors included activities related to radiological controls (which has been one of the 2 largest contributors for the last 2 quarters) and operations-related procedure violations (i.e., Standard Operating Procedures).

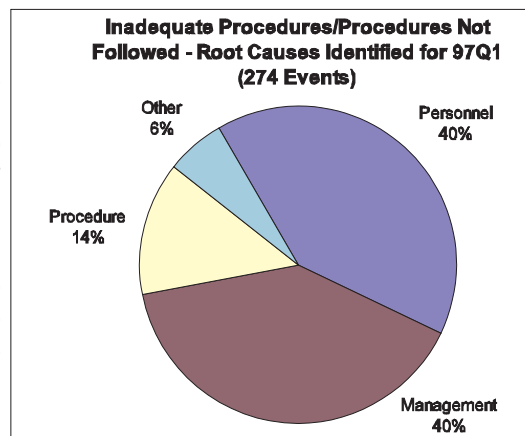


Distribution by Location

- The following chart represents a distribution of the 5 major contributors.
 - These same sites have been among the top contributors since 93Q1.
 - Savannah River continues to be the leading contributor, as was the case in 97Q1. The number of events at this site increased 15%, from 41 in 97Q1 to 47 in 97Q2. The leading contributor to the procedural violations at this site appears to be related to maintenance activities. This was also the case for the second leading contributor, Rocky Flats.
 - The majority (48%) of procedural-related events at Hanford were related to either radiological work or the storage and handling of radioactive material.

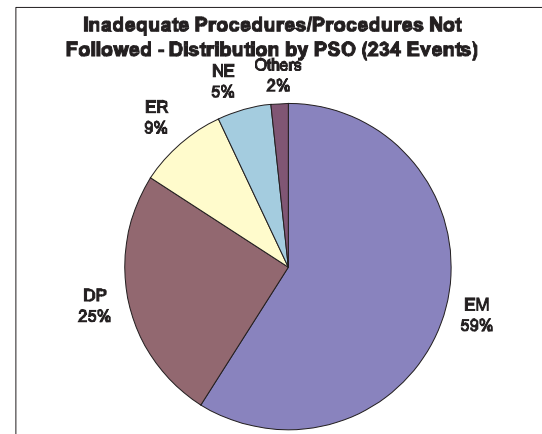
**Distribution by Root Cause**

- The following chart represents a distribution of the number of Inadequate Procedures/Procedures Not Followed events by root cause for 97Q1.
- As has been the case since 93Q1, for those events with root causes identified, the top 3 cited root cause categories were personnel (111 events), management (109 events), and procedure (37 events).
 - Of the personnel errors cited, inattention to detail and procedures not used or used incorrectly were the top 2 contributors. This is consistent with 96Q4.
 - The top 2 management causes cited were inadequate administrative controls and policies not adequately defined, disseminated, or enforced.
 - Defective or inadequate procedure was the major procedural root cause identified.



Distribution by PSO

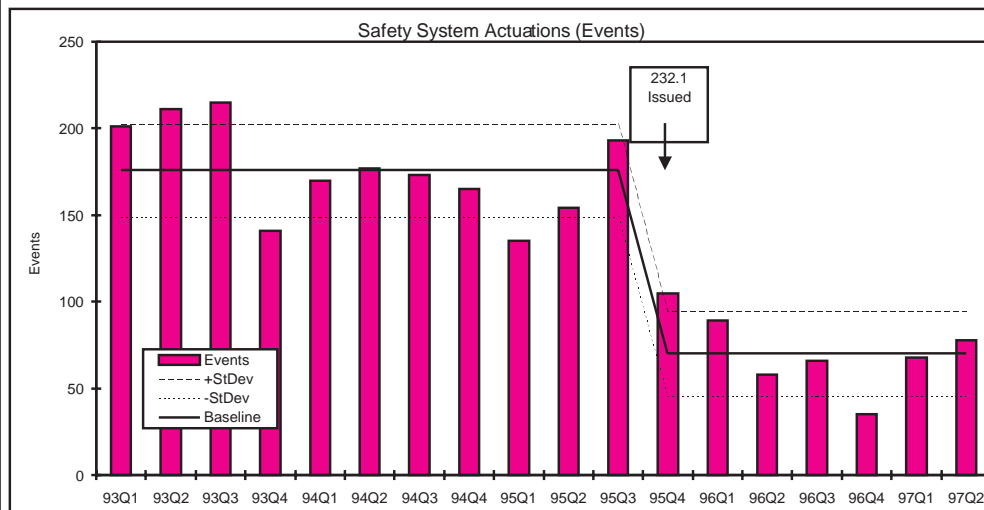
- The following chart represents a distribution of the number of Inadequate Procedures/Procedures Not Followed events by Program Secretarial Office (PSO) for 97Q2.



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Indicator 15. Safety System Actuations

Definition Number of operations related events determined to be safety system actuations reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. This includes real actuation of any safety class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruption of facility activity related to weather phenomenon, facility evacuations, or loss of process ventilation. These events have the potential to impact the safety and health of workers in the vicinity.

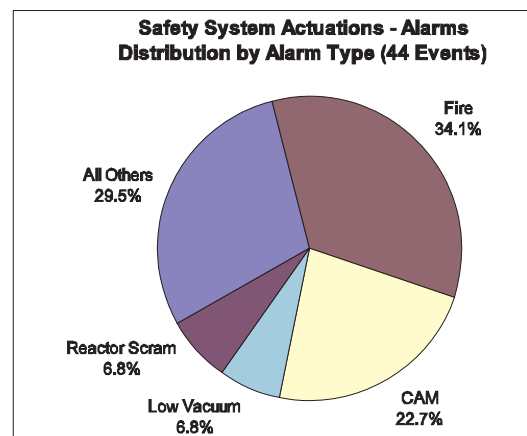


Source: Review of Occurrence Reports by Department analysts.

- Key Observations**
- Since the full implementation of DOE Order 232.1 in 96Q1, there have been an average of 65 safety system actuations per quarter. The number of actuations reported in 97Q2 is somewhat higher (78) than this average but does not suggest an increasing trend at this time.

Additional Analysis Distribution by Alarm Type

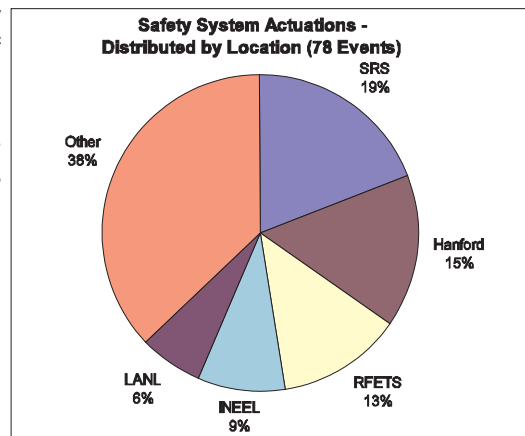
- Of the 78 safety system actuations reported in 97Q2, 44 involved the actuation of alarms. The following chart represents the distribution of these alarms by the alarm type.



- System failures also constitute a portion of the safety system actuations reported in 97Q2. The three primary contributors are electrical system failure (23), process ventilation system failure (19), and service system failure (10).
- Weather phenomenon was a factor in 8 of the reported safety system actuations in 97Q2.
- Of the 78 safety system actuations reported in 97Q2, 21 resulted in facility evacuation, three of which were the result of bomb scares.

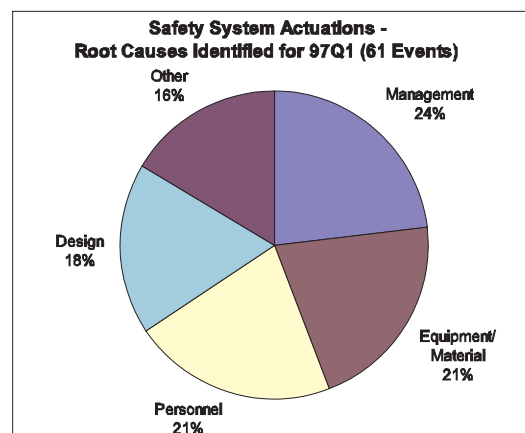
Distribution by Location

- The safety system actuations events reported in 97Q2 were analyzed as to the location where the actuation occurred. The following chart represents this analysis.
- Los Alamos National Laboratory (LANL) reduced the number of safety system actuations from 10 in 97Q1 to 5 in 97Q2 and represents the fewest number of actuations reported since 93Q1. However, this decrease is offset by an increase in the number of actuations reported by Savannah River from 10 in 97Q1 to 15 in 97Q2.



Distribution by Root Cause

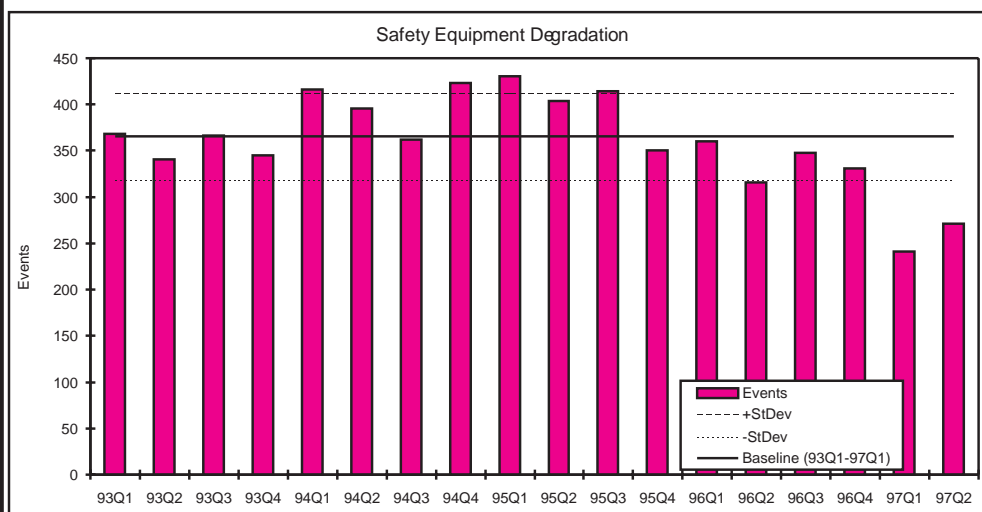
- The following chart represents the distribution of safety system actuation events for 97Q1 by root cause for those events in which a root cause has been identified.



Indicator 16. Safety Equipment Degradation

Definition Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillance/inspections and appraisal findings of any safety class SSC.



Source: Review of Occurrence Reports by Department analysts.

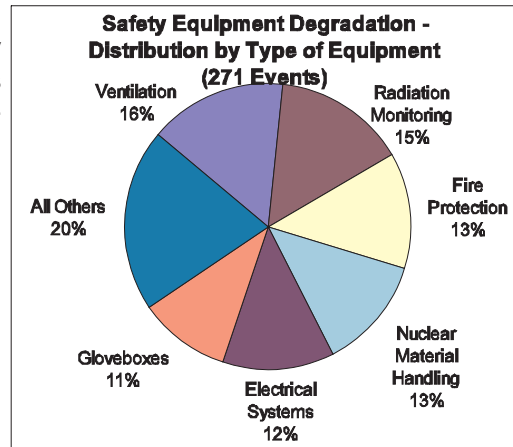
Key Observations

- In 97Q2, the number of safety equipment degradation events increased by more than 12% over the 97Q1 value (from 241 events in 97Q1 to 271 events in 97Q2).
- Even taking the increase in 97Q2 events into account, there continues to be a highly probable decreasing trend over the last 4 quarters.

Additional Analysis**Distribution by Type of Equipment**

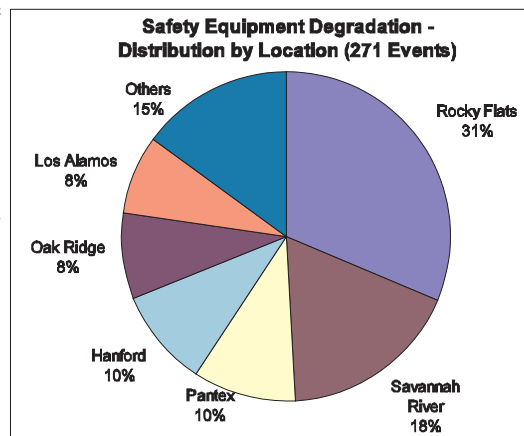
- As was the case in 97Q1, ventilation equipment and radiation monitoring equipment were the 2 major contributors. Nuclear material handling equipment and gloveboxes were also significant contributors last quarter.

- For ventilation system equipment, the single largest contributor (over 30%) was degraded fans. Pressure Differential Indicating Controllers (PDICs) was the second most frequently cited type of degraded equipment.
- For radiation monitoring equipment, the leading type of equipment, by far, was the Continuous Air Monitors (CAMs). This equipment contributed over 50% to the total.



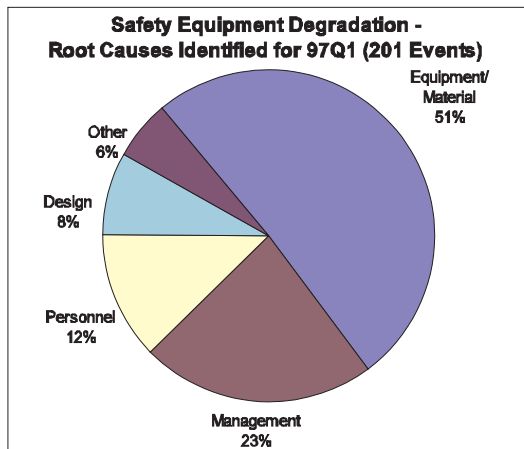
Distribution by Location

- The following chart represents a distribution of the 6 major contributors.
- The increase in the total number of safety equipment degradation events is largely attributable to increases in these events experienced at Rocky Flats and Pantex.
- As was the case in 97Q1, Rocky Flats and Savannah River continued as the leading contributors (Rocky Flats had 74 events in 97Q1 and 85 in 97Q2 while Savannah River experienced 43 events in 97Q1 and 48 in 97Q2).
- The increase in the number of events at Rocky Flats appears to be related to the large number of degraded CAMs, ventilation fans, glovebox and fire protection sprinkler system degradations.
- The number of events at the Pantex Plant showed a significant increase in 97Q2 (from 11 in 97Q1 to 27 in 97Q2). This increase appears to be a result of an increase in the number of events involving the fire/smoke detection system and explosives storage/safety systems.

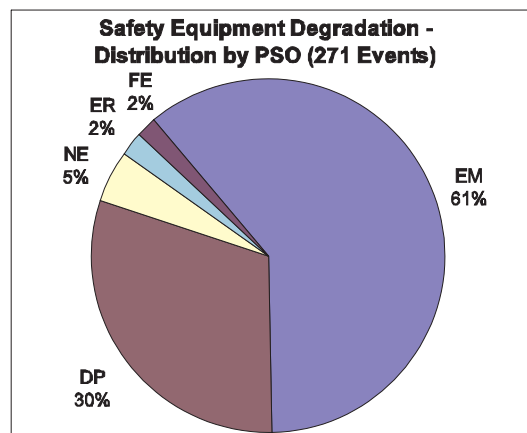


Distribution by Root Cause

- Of the 241 events reported in 97Q1, 201 (or 83%) had established root causes.
- The root cause for 102 of the events was cited as equipment/material problems. Of these, the 2 most significant sub-categories of root cause were defective or failed part (71 events) and end-of-life failure (23 events).
- The distribution by root cause was consistent with 96Q4 data.

**Distribution by PSO**

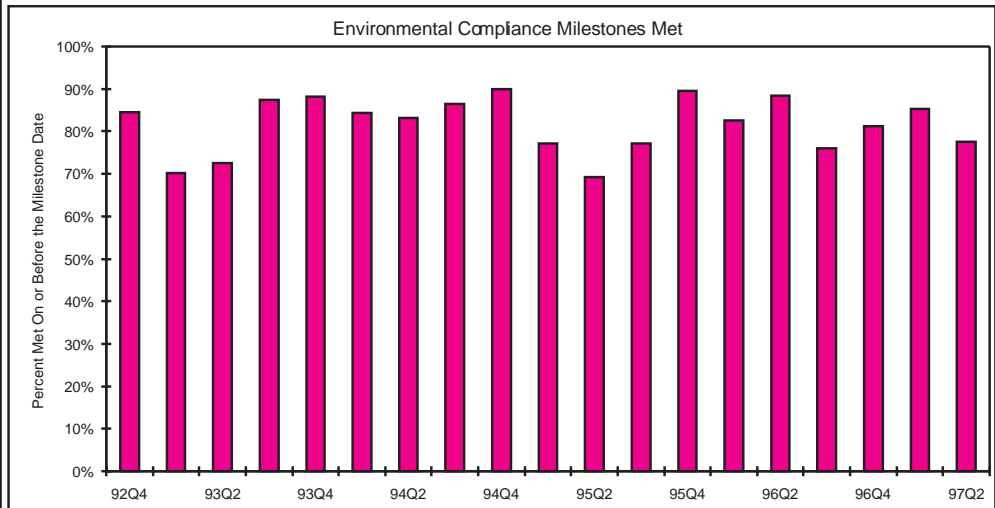
- The following graph represents a distribution of the number of safety equipment degradation events by Program Secretarial Offices (PSO).



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Indicator**17. Environmental Compliance Milestones Met****Definition**

Enforceable requirements in environmental agreements, met on or before the milestone date (percent).



Source: Progress Tracking System Data, Office of Environmental Management, EH-41.

Key Observations

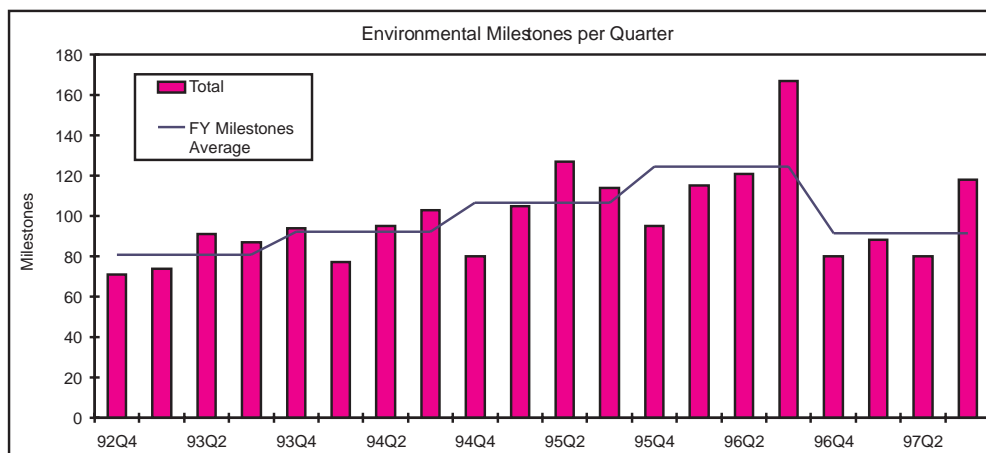
- In 97Q2, DOE met 78% of its enforceable milestones. Over the previous four quarters DOE met 82% of its milestones.

Additional Analysis

- At the end of 97Q2, DOE projected that it could meet 78% of the milestones in 97Q3. Since past projections of future quarters have always proved optimistic, the actual performance is likely to be worse than this. [For example: two quarters ago, the performance level for this quarter (97Q2) was projected as 95%; one quarter ago (97Q1) the level projected for this quarter was 85%; the actual performance was 78%. At the end of 96Q1, the projected performance for 96Q3 was 94%; actual performance was 76%. At the end of 97Q1, the projected performance for 97Q3 was 84%.]
- In each of the past three quarters, 5 or 6 of the 16 sites had 6 or more milestones; these account for more than two-thirds of the milestones. The performance of the sites with 6 or more milestones in a quarter is consistently better than the performance of the balance of the sites.

	96Q4	97Q1	97Q2
≥ 6 milestones	85%	88%	92%
< 6 milestones	76%	78%	56%

- There are currently 366 milestones identified for fiscal year 1997. This compares with 498 in FY 1996 and 323 in FY 1993. The third quarter (end of the fiscal year) consistently has a disproportionate number of milestones.

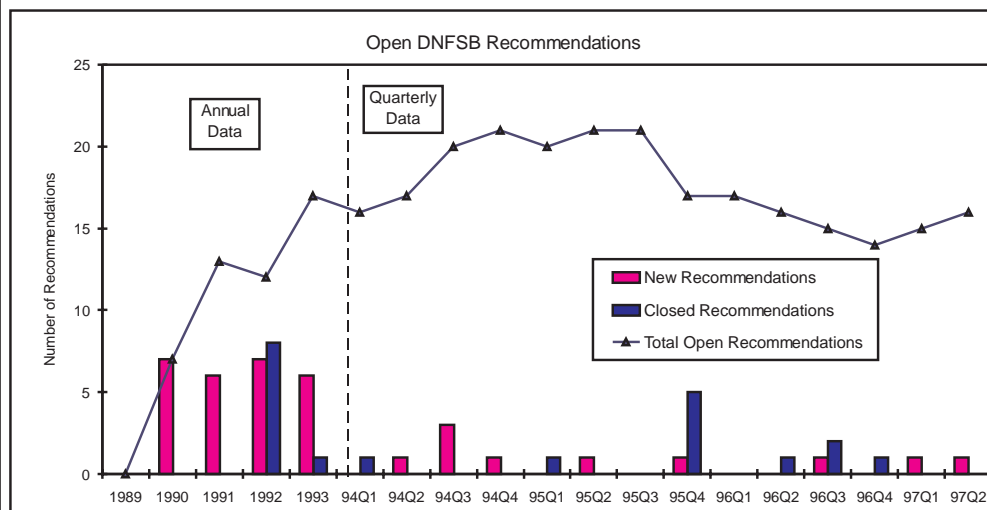


- These data do not capture all enforceable milestones; they reflect those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85–90% of all DOE enforceable environmental milestones.

Indicator 18. Open DNFSB Recommendations

Definition The cumulative number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities involved in nuclear safety issues.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System (SIMS).

Key Observations

- As of June 1997, there were 16 open DNFSB recommendations representing 620 DOE commitments. 65% of the commitments were considered to be satisfied or fulfilled. Recommendation 97-2 (Continuation of Criticality Safety) was received from the Board during 97Q2, while no recommendations were closed.

Additional Analysis

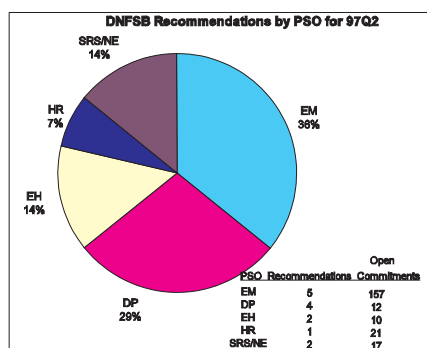
- Environmental Management (EM) and Defense Programs (DP) continue to be responsible for implementing most of the recommendations. The cumulative subtotals through 97Q2 are represented in the following table. Recommendations 97-1 (Safe Storage of Uranium 233) and 97-2 (Continuation of Criticality Safety) do not currently have approved implementation plans and, therefore, do not represent any commitments.

Office	DNFSB Recommendations	Commitments	Fulfilled	Not Yet Due	Overdue	Open
EM	5	395	238 (60%)	133 (34%)	24 (6%)	157 (40%)
DP	4	106	94 (89%)	11 (10%)	1 (1%)	12 (11%)
EH	2	21	11 (52%)	4 (19%)	6 (29%)	10 (48%)
HR	1	66	45 (68%)	3 (5%)	18 (27%)	21 (32%)
SRS/NE	2	32	15 (47%)	15 (47%)	2 (6%)	17 (53%)
Total	14	620	403 (65%)	166 (27%)	51 (8%)	217 (35%)

- 2 of the 16 open recommendations have 100% of the associated commitments complete (93-6 and 95-1). The Department proposed closure of Recommendations 93-6 (Nuclear Weapons Expertise) in December 1996 and 95-1 (Cylinders Containing Depleted Uranium) in June 1997.

Distribution of Open Commitments

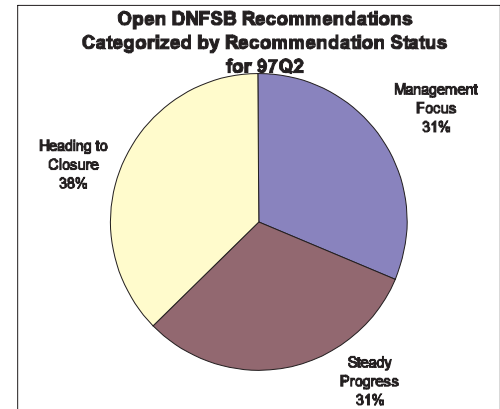
- The number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans) continues to improve. At the end of March 1997, there were 233 open commitments and June 1997 ended with 217 open commitments.



Characterization of Recommendation Status

- The graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of "Heading to Closure" includes the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. "Steady Progress" implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (10) of overdue commitments.

- Two recommendations were added to the Management Focus category during 97Q2. These included Recommendation 94-1 (Improved Schedule for Remediation) which was moved from the Steady Progress category to Management Focus since ten commitments are overdue, and Recommendation 97-2 (Continuation of Criticality Safety at Defense Nuclear Facilities), issued May 1997, for which an implementation plan is being developed.



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Indicator 19. Enhanced Work Planning Implementation

Definition The number of facilities that have implemented Enhanced Work Planning (EWP) divided by the total number of facilities throughout the DOE complex.

Enhanced Work Planning is defined as a process that evaluates and improves the site programs by which work is identified, planned, approved, controlled, and executed.

The key elements that make up EWP are:

Line management ownership of the responsibility for safety, health, and quality assurance.

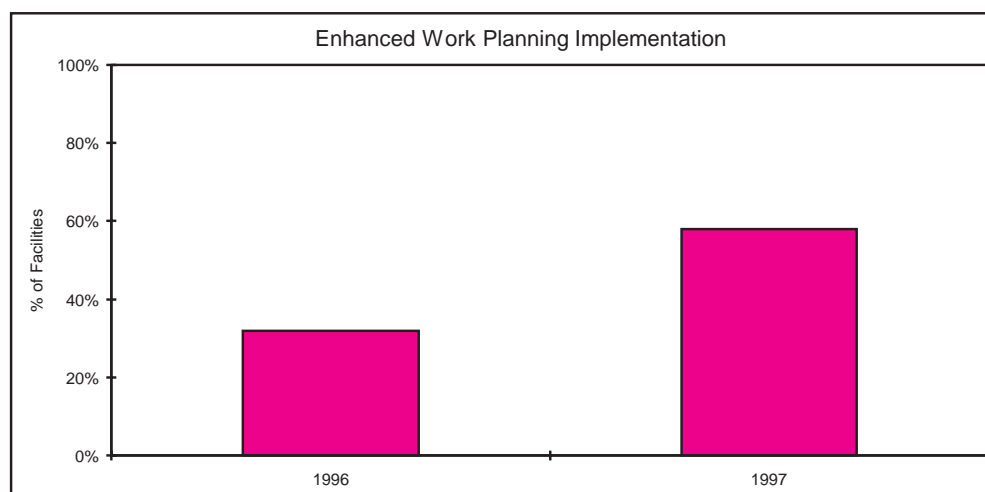
Organizationally diverse teams representing various work-related disciplines including: planners, engineers, workers, ES&H professionals, training professionals, management, etc. . . . eliminating the need for sequential work review and promoting synergism with respect to potential safety, operational, and productivity issues.

A graded approach to work management, based upon risk and complexity.

Worker involvement beginning at the earliest phases of work management providing a unique perspective into the work planning process and promoting ownership for the various processes.

Organized, institutionalized communication between those sites initiating pilot projects and those with established successful EWP programs.

For the purposes of this indicator, a facility is defined as a DOE building as described in the DOE Office of Oversight's Site Profiles. This list was further supplemented with additional facilities not covered in the Site Profiles such as, the Ames and Fermi Laboratories as well as DOE's petroleum reserves among others.

**Key Observations**

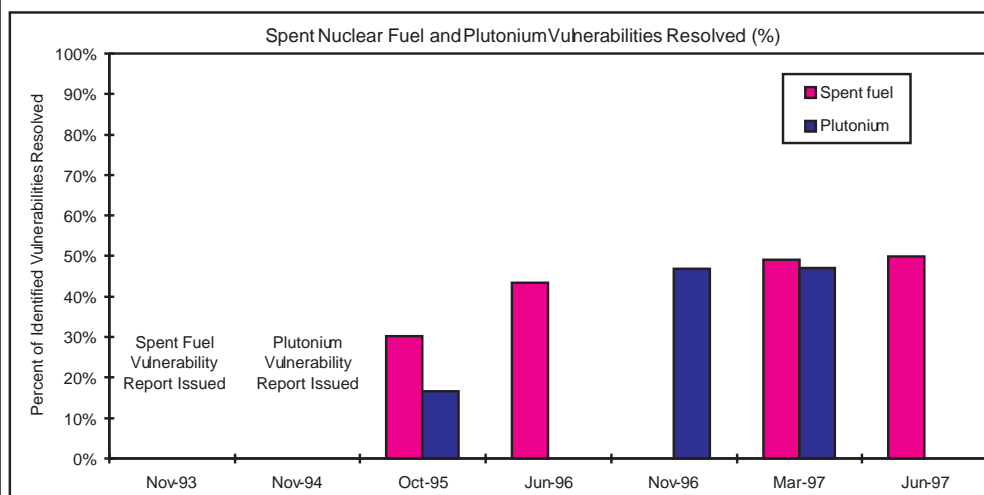
- The percentage of DOE facilities which participated in the implementation of enhanced work planning practices increased from 32% in 1996 to 58% in 1997.

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Indicator 20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition The number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel...and Their Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure of the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.



Source: Draft Plutonium Vulnerability Management Summary Report, June 1997 (EM-66). Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, June 1997 (EM-67).

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- As of 97Q1, 47% of the identified plutonium vulnerabilities have been resolved.
- As of 97Q2, 50% of the identified spent fuel vulnerabilities have been resolved.

Additional Analysis

- The most spent nuclear fuel vulnerabilities (34%) were identified at Hanford, which maintains 80% of the DOE total spent nuclear fuel inventory by weight.

- There are 524 identified corrective actions for the 106 spent fuel vulnerabilities. Of these 524 corrective actions, 382 (73%) have been completed. Only 1 of the open corrective actions is overdue.
- The following table indicates the breakdown of spent nuclear fuel vulnerabilities as of 97Q2 by location and the progress in resolving the identified vulnerabilities.

Spent Nuclear Fuel Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Hanford	36	21	58%
Idaho	33	5	15%
Savannah River	21	17	81%
All Others	16	10	63%
Total	106	53	50%

- The most plutonium vulnerabilities (87) were identified at Rocky Flats, which maintains 80% of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 15 have been eliminated and an additional 18 have had the risk reduced to an acceptable level.
- Los Alamos had similar results in closing plutonium vulnerabilities with 14 vulnerabilities eliminated and the risk in 27 other issues reduced to an acceptable level.
- 15 of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. 7 were eliminated; the risk for 8 other issues has been reduced to an acceptable level.
- The following table indicates the breakdown of plutonium vulnerabilities as of 97Q1 by location and the progress of resolving the identified vulnerabilities.

Plutonium Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Rocky Flats	87	33	38%
Los Alamos	60	41	68%
Savannah River	40	10	25%
Hanford	34	9	26%
All Others	78	47	60%
Total	299	140	47%

Vulnerability resolution status has been updated for this report from the Draft Plutonium Working Group dated March 1997.

Indicator**21. Plutonium Stabilization****Definition**

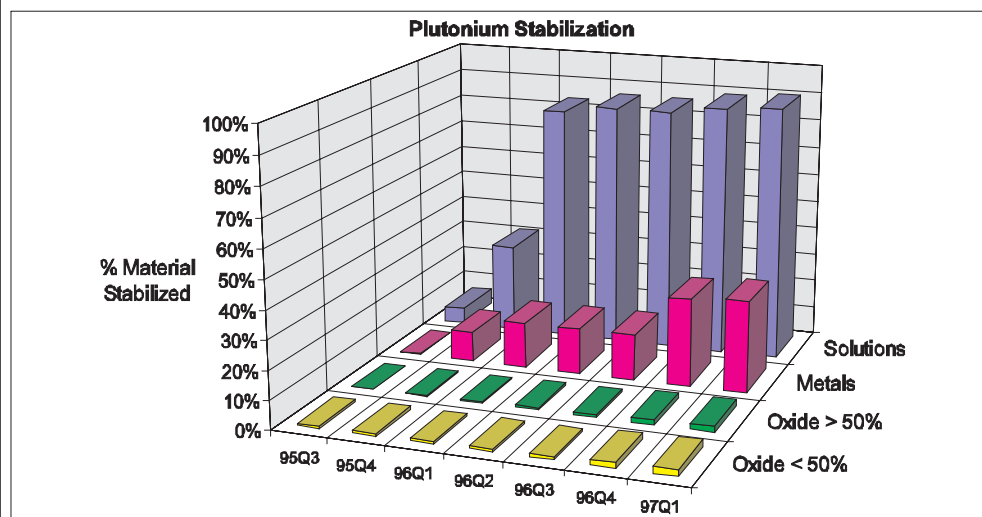
Progress in plutonium (Pu) stabilization as outlined in the DOE implementation plan response to DNFSB Recommendation 94-1. The performance measure is depicted in cumulative percentages of the total inventory (in stabilization units; SU) of plutonium solutions, metals, and oxides that are stabilized.

1 Pu solution SU = 4000 liters

1 metal SU = 90 kg

1 oxide SU = 60 kg

No changes to this section since last report.



Source: Nuclear Materials Stabilization Task Group Quarterly Report. BNL Data Base on Plutonium Stabilization.

Key Observations

- Only modest progress was made in stabilizing plutonium during 96Q4 and 97Q1. During this time period, 5,629 liters of the remaining 57,950 liters of plutonium solution were stabilized. Of the remaining 17,724 kgs of plutonium metal and oxides to be stabilized, 302 kgs were stabilized during 96Q4 and 97Q1.

Additional Analysis

- Only Rocky Flats and Los Alamos National Laboratory reported progress in stabilizing plutonium inventories during 96Q4 and 97Q1. Specifically, Rocky Flats was responsible for all the plutonium solution and oxide stabilized while Los Alamos National Laboratory reported all the plutonium metal stabilized.
- It is recognized that there is not a one-to-one correlation between the quantity of plutonium stabilized and the associated reduction in risk to DOE workers, the public, or the environment. Factors such as material form and packaging play an important role in accurately measuring risk reduction. Additional efforts are needed to fully evaluate risk reduction related to plutonium stabilization activities.

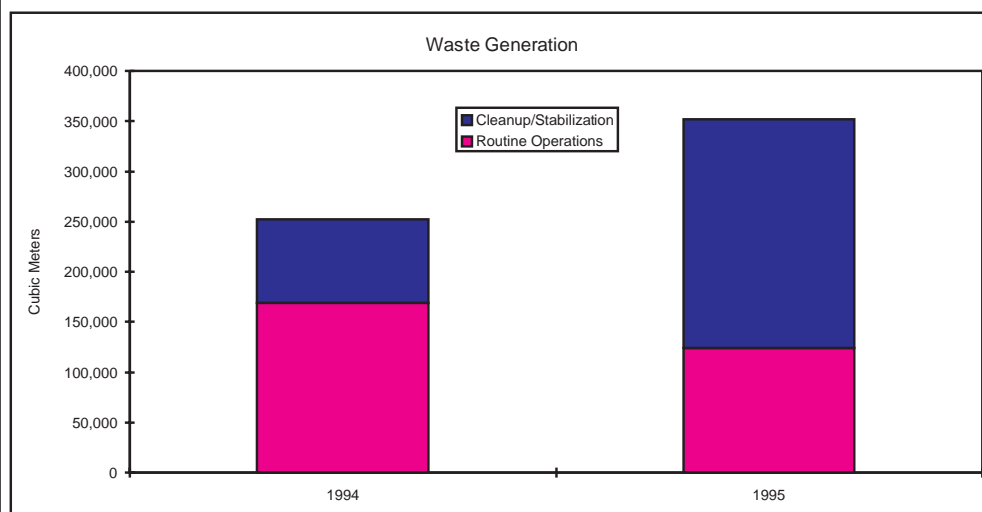
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Indicator 22. Waste Generation**Definition**

Total amount of waste generated, in cubic meters, for all DOE Sites. Waste types generated include High Level Radioactive, Transuranic, Low Level Radioactive, Low Level Mixed, Hazardous, and Sanitary. These waste types are generated during routine operations or cleanup/stabilization activities.

- Routine operations waste consists of normal operation waste produced by any type of production operation; analytical and/or research and development laboratory operations, treatment, storage and disposal operations; "work for others"; or any other periodic or recurring work that is considered ongoing in nature.
- Cleanup/stabilization waste, including primary and secondary waste, is generated by the environmental restoration of contaminated media (soil, groundwater, surface water, sediments, etc.); stabilization of nuclear and nonnuclear (chemical) materials; and deactivation and decommissioning of facilities.

No changes to this section since last report.



Source: Waste Minimization Reporting System, Office of Environmental Management.

Key Observations

- The overall amount of waste generated increased from 250,413 cubic meters to 351,883 cubic meters from 1994 to 1995. However, during this same time period, the amount of waste generated during routine operations (excluding sanitary) decreased 37% (from 49,897 cubic meters to 31,433 cubic meters), while the amount of waste generated during cleanup/stabilization operations (excluding sanitary) increased 66% (from 74,967 cubic meters to 124,519 cubic meters). During the same time period, the sanitary waste generated increased 41% (from 126,549 cubic meters to 195,931 cubic meters). In 1994, data was not collected for sanitary waste based on the production source of routine versus cleanup/stabilization activities.

Additional Analysis

- The following tables subcategorize waste generation based on production source: routine or cleanup/stabilization activities.

Waste Generated During Routine Activities (cubic meters)

Waste Type	1994	1995
High Level Radioactive	2,071	2,496
Transuranic	568	336
Low Level Radioactive	29,920	21,281
Low Level Mixed	2,837	1,868
Hazardous	14,501	5,452
Sanitary	Note 1	92,544

Note 1—Sanitary Waste was not subcategorized in 1994.

Waste Generated During Cleanup/Stabilization Activities (cubic meters)

Waste Type	1994	1995
Transuranic	192	156
Low Level Radioactive	45,887	92,968
Low Level Mixed	13,040	5,563
Hazardous	15,848	25,832
Sanitary	Note 1	103,387

Note 1—Sanitary Waste was not subcategorized in 1994.

- From 1994 to 1995, waste generated during routine activities decreased by 29% for Low Level Radioactive Waste, 34% for Low Level Mixed Waste, 41% for Transuranic Waste, and 62% for Hazardous Waste.
- From 1994 to 1995, waste generated during cleanup/stabilization activities increased 103% for Low Level Radioactive Waste. 89% of the increase was due to the Fernald Environmental Management Project generating an additional 41,687 cubic meters during remediation activities.
- From 1994 to 1995, waste generated during cleanup/stabilization activities increased 103% for Low Level Radioactive Waste. 89% of the increase was due to the Fernald Environmental Management Project generating an additional 41,687 cubic meters during remediation activities.
- Sanitary Waste accounted for 50% of all waste generated in 1994 and 56% in 1995. In 1995, Sanitary Waste generated during cleanup/stabilization activities accounted for 53% of the Sanitary Waste generated and 29% of all waste generated in the DOE complex. A comparison cannot be made to 1994 because Sanitary Waste was not subcategorized based on production source.



Indicator **23. HEU Vulnerabilities Resolved**

Definition The percentage of vulnerabilities identified in the *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium* (DOE/EH-0525) that have been resolved.

Key Observations

This indicator will be used to measure the progress in resolving the total of 155 ES&H vulnerabilities found in the assessment, and also specific subsets of these vulnerabilities: 1) the facility and material condition vulnerabilities ranked by the HEU Working Group as being of highest significance, 2) vulnerabilities at specific sites, and 3) vulnerabilities involving U-233.

A significant fraction of the HEU's Working Group assessment involved U-233, stemming from this isotope's particular radiological properties (and those of U-232 co-produced with U-233). The HEU Working Group concluded that a special management plan is needed for safe interim storage of U-233 materials. Thus, U-233 vulnerabilities will be tracked as a separate group, even though this will involve "double counting" of some vulnerabilities ranked as having the highest significance.

No changes to this section since last report.

An ES&H vulnerability is defined in the HEU Working Group Report as "conditions or weaknesses that could result in the exposure of workers or the public to radiation, or in releases of radioactive materials to the environment." Led by the Office of Defense Programs (DP), DOE has developed the *HEU Vulnerability Management Plan* (currently in draft) that outlines a process for corrective actions and resolution of the HEU vulnerabilities. DP will track the resolution of the HEU vulnerabilities and report these either by a separate quarterly status report, or by information included in status reports that combine HEU vulnerability resolution with those for plutonium and/or spent fuel vulnerabilities.

The following table summarizes the Department-wide status of HEU vulnerability resolution:

HEU Vulnerability Set	Vulnerabilities Identified	Vulnerabilities Resolved	P.I. = % Resolved
Total, DOE-Wide	155		
Highest Significance	21		
U-233 Vulnerabilities	13		

The following table summarizes vulnerabilities on a site basis. Note that the Oak Ridge Y-12 Plant stores a far greater amount of HEU (greater than 189 metric tons) than any other site. Note also that ORNL and INEEL have the largest quantities of U-233 (424 and 40 kilograms, respectively).

Additional Analysis

HEU Site	Vulnerabilities Identified	Vulnerabilities Resolved	P.I. = Resolved
Oak Ridge Y-12 Plant	49		
Rocky Flats Env. Tech. Site	28		
Los Alamos National Lab	19		
Portsmouth Gaseous Dif. Plant	16		
Idaho Nat. Engineering & Environmental Lab	10		
Savannah River Site	9		
Oak Ridge K-25 Site	9		
Oak Ridge National Lab	6		
Pantex Plant,	5		
Sandia National Laboratories	1		
Argonne National Lab-West	1		
Lawrence Livermore Nat. Lab	1		
New Brunswick Laboratory	1		

As of this report, the HEU Vulnerability Management Plan was still in draft. When finalized, this plan will set dates for resolution of the 21 HEU vulnerabilities designated by the HEU Working Group as being of highest significance. Thus, tracking of the PIs for these 21 vulnerabilities can be shown against scheduled completion dates after the Management Plan is issued.

The resolution of the other 134 HEU vulnerabilities identified in the HEU Vulnerability Assessment will depend on site-specific plans. Many of the plans may become part of existing plans for DNFSB 94-1. Because of the need to work with separate field offices, scheduling and tracking of PIs concerning the other 134 vulnerabilities will take more effort and time to perform than those explicitly covered in the HEU Management Plan.

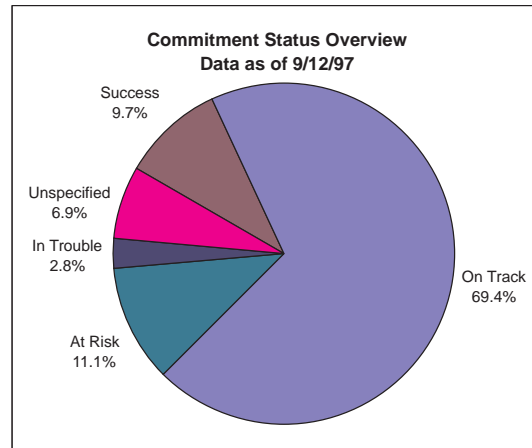
On March 3, 1997, the DNFSB issued Recommendation 97-1 which concerns the safety of U-233. Many of the Board's recommendations reflect findings and conclusions made in the HEU Vulnerability Assessment. DOE owes an Implementation Plan for Recommendation 97-1 by April 11, 1997, unless an extension is granted. This response could significantly change the current draft HEU Management Plan. Scheduling and tracking of the PI associated with U-233 vulnerabilities may thus need to wait until DOE develops a plan for DNFSB 97-1.

The Secretary's Commitments to the President in EQ and ES&H

Environmental Quality (EQ) and Environment, Safety and Health (ES&H) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1997 are summarized below.

More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at:

<http://www.doe.gov/policy/library/sagrec97.html>



ENVIRONMENTAL QUALITY (EQ.)

ACCELERATING RISK REDUCTION AND LIFECYCLE COST REDUCTION OF NUCLEAR WEAPONS SITES CLEANUP (EQ-01) (At Risk): Commitment Description: Initiate the implementation of the Environmental Management (EM) Ten-Year Vision to complete the cleanup of most of the Department's contaminated sites over the next 10 years and to put in place a responsible waste management, nuclear materials, and surplus facilities stewardship program for the long-term future. (EM)

- Releasing the discussion draft of the Environmental Management Progress Plan for Cleanup for public review and comment by June 1997. (EQ-01.1) (Success)
- Implementing the EM Integrated Planning, Accountability, and Budgeting System by September 1997. (EQ-01.2) (Success)
- Completing the cleanup of the Pinellas Plant, closing it, and turning it over to the Pinellas County by September 1997. This is the first surplus weapons production site to be closed by the Department. (EQ-01.3) (Success)
- Accelerating the complete deactivation of the PUREX plant at the Hanford Site from the original schedule of FY 1998 to FY 1997 with an estimated cost reduction of \$43.4 million. (EQ-01.4) (Success)
- Continuing the development of the privatization strategy to provide alternative methods for accelerating cleanup and reduce cost through competition, private sector financing, and the application of proven private sector technology and experience by: - Issuing request for proposals for contact handled transuranic waste transportation at Carlsbad, New Mexico, by September 1997. - Issuing

request for proposals for the Broad Spectrum Low Activity Mixed Waste Treatment at Oak Ridge Reservation by September 1997, and - Issuing request for proposals for the Waste Pit Remedial Action at Fernald, Ohio, by January 1997. (EQ-01.5) (In Trouble)

MAKING PROGRESS ON THE TREATMENT, STORAGE, AND DISPOSAL OF RADIOACTIVE WASTES (EQ-02) (At Risk): Safely store radioactive and hazardous wastes and reduce environmental risk by treating and disposing of transuranic, mixed low level, and low level wastes. (EM) Although the third measure is assessed "in trouble," practically speaking it is "on track". The Records of Decision (RODs) will be issued in October 1997. The delay in issuing the RODs will not impact the schedule for opening WIPP, provided they are issued before April 1998.

- Issuing the Final Waste Management Programmatic Environmental Impact Statement by June 1997. (EQ-02.1) (Success)
- Issuing the Final Waste Isolation Pilot Plant (WIPP) Supplemental Environmental Impact Statement by September 1997. (EQ-02.2) (On Track)
- Issuing Records of Decision on treatment, storage, and disposal of transuranic waste by September 1997. (EQ-02.3) (In Trouble)
- Producing at least 270 canisters of vitrified high level waste for future repository disposal. (EQ-02.4) (On Track)
- Treating approximately 6,000 cubic meters of mixed low level waste and disposing of approximately 38,000 cubic meters of low level waste. (EQ-02.5) (At Risk)
- Awarding a contract for an advanced mixed waste treatment facility at the Idaho National Engineering Laboratory by December 1996. (EQ-02.6) (Success)

REDUCING THE RISKS; CLEANING UP NUCLEAR WEAPONS SITES (EQ-03) (At Risk): Protect human health and the environment from risks posed by inactive and surplus DOE facilities and contaminated areas. (EM) All but one measure are on track. The completion of cleanup at three geographic sites was delayed due to factors beyond program control.

- Completing cleanup at 13 EM geographic sites. This will bring the cumulative number of completed geographic sites to 65 out of a total universe of 132 geographic sites to be remediated. (EQ-03.1) (In Trouble)
- Completing remedial actions at approximately 400 release sites. This will bring the cumulative number of completed release sites to approximately 3,600 out of a total universe of 8,826 release sites. (EQ-03.2) (On Track)
- Completing approximately 70 facility decommissionings. This will bring the cumulative number of completed facility decommissionings to approximately 310 out of a total universe of 1,090 facilities. (EQ-03.3) (On Track)
- Stabilizing approximately 100 kg of plutonium across EM sites. (Success) EQ-03.4

FINDING SOLUTIONS TO SPENT NUCLEAR FUEL STORAGE AND FUNDING ISSUES (EQ-04) (Success): Refocus the Civilian Radioactive Waste Management Program to provide meaningful deliverables that are consistent with reduced funding and revised policies. (RW)

- Completing the excavation of the Exploratory Studies Facility main 5-mile loop and selected scientific instrumentation alcoves to support studies for a viability assessment of the Yucca Mountain site in September 1998 and subsequent site suitability determination and licensing. (EQ-04.1) (Success)

- Submitting the Topical Safety Analysis Report to the Nuclear Regulatory Commission for a non-site specific Phase I interim storage facility design to assist in maintaining a readiness capability should interim storage be authorized by legislation. (EQ-04.2) (Success)
- Issuing a Revised Notice of Proposed Policy and Procedures under Section 180(c) of the Nuclear Waste Policy Act, which provides for technical and financial assistance to States and Indian Tribes for training public safety officials through whose jurisdictions spent nuclear fuel and high-level waste would be transported, in preparation for an orderly transportation activity. (EQ-04.3) (Success)
- Issuing a draft request for proposals to provide waste acceptance and transportation services and equipment for commercial spent nuclear fuel, to carry on collaboration with the nuclear utilities and other stakeholders to resolve issues, and develop the management and logistical capability in the private sector. (EQ-04.4) (On Track)

SHUTTING DOWN AND CLEANING UP SURPLUS NON-WEAPONS NUCLEAR REACTOR SITES (EQ-05) (On Track): Safely deactivate surplus nuclear facilities, including the Experimental Breeder Reactor-II (EBR-II) in Idaho, and prepare wastes for interim storage and ultimate disposition. (NE)

- Removing the remaining EBR-II fuel (53 assemblies, as of September 1996) from the reactor by December 1996. (EQ-05.1) (Success)
- Completing construction of the Sodium Processing Facility at Argonne National Laboratory-West by November 1996. (EQ-05.2) (Success)
- Completing the conversion of 30,000 gallons of Fermi reactor sodium, which is currently in storage at Argonne National Laboratory-West, to sodium carbonate by September 1997. (The remaining 47,000 gallons of Fermi sodium is scheduled for conversion to sodium carbonate by the end of December 1997). (EQ-05.3) (On Track)

ENSURING ENVIRONMENTAL JUSTICE (EQ-06) (At Risk: Accelerate waste management, environmental cleanup, remediation, and pollution prevention activities in order to address high and adverse impacts of our facilities on the human health and environment of surrounding communities. (ED)

- Completing the construction of the groundwater remediation system for the F&H Area of the Savannah River Site by July 1997. (EM) (EQ-06.1) (Success)
- Completing 75 percent of the interim cap construction begun in FY 1996 for the Burial Ground Complex at the Savannah River Site. This project, when complete, will reduce the infiltration of rain and surface water into 76 acres of buried waste site by 70 percent. (EM) (EQ-06.2) (Success)
- Completing cleanup activities near the East Fork Poplar Creek community in Oak Ridge. (EM) (EQ-06.3) (On Track)
- Accelerating remediation of environmental contamination and disposal of wastes at the Portsmouth Site, Oak Ridge Operations. (EM) (EQ-06.4) (On Track)
- Continuing technical training and expanding access of information on subsistence-related health risks to affected populations and professionals in medical, scientific, and public health, by providing interactive internet-based tools and newsletters. (EQ-06.5) (In Trouble)

PREVENTING FUTURE POLLUTION (EQ-07) (On Track): Reduce the generation of all waste streams in order to minimize the impact of the Department's operations on the environment, reduce operational cost, and improve the efficiency of its operations. (EM)

- Completing pollution prevention plans showing waste reduction goals for 30 reporting sites by September 1997. (EQ-07.1) (Success)
- Completing at least 100 pollution prevention projects that reduce/avoid the generation of radioactive and mixed wastes by 4000 cubic meters by September 1997. (Data for reporting available at end of calendar year 1997). (EQ-07.2) (Success)
- Ensuring that 60 percent of DOE purchases of EPA-designated products contain recycled or recovered materials, except where excluded by Section 402(b) of Executive Order 12873. (Data for reporting available at end of calendar year 1997). (EQ-07.3) (On Track)

NEGOTIATING INTERNATIONAL SUSTAINABLE DEVELOPMENT AGREEMENTS (EQ-08) (On Track): Further developing institutions required for solving global environmental problems. (PO)

- Having U.S. proposals adopted in the United Nations organizations on climate change, sustainable development, shipment and disposal of hazardous wastes, and long-range transport of air pollution. (EQ-08.1) (On Track)
- Having "joint action plans" in place with at least two countries to promote environmental security interests of the United States. (EQ-08.2) (On Track)

ENVIRONMENT, SAFETY, AND HEALTH (EH.) (In Trouble)

IMPROVING EFFICIENCY AND EFFECTIVENESS OF PROTECTING WORKERS, THE PUBLIC, AND THE ENVIRONMENT (EH-01) (On Track): Prevent worker accidents, protect the public and environment, while saving time and resources through safety and health contract provisions and more effective work planning. (EH)

- Incorporating strong and effective safety management systems provisions in four Management and Operation contracts to protect environment, safety, and health. (EH-01.1) (On Track)
- Implementing Enhanced Work Planning at major DOE sites over the next three years by involving approximately a third of the DOE workers every year in more effective work planning and hazard identification. (EH-01.2) (On Track)

IDENTIFYING PRACTICAL WAYS TO ADDRESS THE MOST SIGNIFICANT HEALTH RISKS TO FORMER WORKERS (EH-02) (On Track): Survey selected former workers and workplace hazards to examine possible links between hazardous substances exposure during work and adverse health effects. (EH)

- Success will be measured in FY 1997 by completing six assessments, which will establish the basis for a more comprehensive program of medical follow-up of former workers. (EH-02.1) (On Track)

PRESERVING AND PROTECTING VALUABLE RUSSIAN RECORDS (EH-03) (In Trouble): Ensure the archival preservation of vulnerable and fragile Russian worker radiation records in the Urals, to help the U.S. gain further insight into radiation safety. (EH) Travel postponed due to Vice Presidential visit. Preservation will be complete during first quarter FY 1998.

- Completing the preservation microfilming of worker dosimetry records at Mayak. (EH-03.1) (In Trouble)

MAINTAINING A MULTI-DISCIPLINARY INDEPENDENT OVERSIGHT PROCESS (EH-04) (On Track): Maintain a multi-disciplinary, fully integrated oversight process for independently evaluating environment, safety, and health, and safeguards and security programs. (EH)

- Completing value-added, comprehensive oversight evaluations, focusing on environment, safety, and health-management systems at four DOE sites before October 1997. (EH-04.1) (On Track)

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Relationship to DOE Strategic Plan Goals

Eliminate Hazards and Releases***Performance Requirements******Establish Priorities******Demonstrate Performance***

DOE STRATEGIC PLAN (April 1994)	PERFORMANCE INDICATORS
<u>Environment, Safety & Health Goal 1</u> <i>Empower workers and take other necessary actions to prevent all serious injuries and all fatalities, and to eliminate all worker exposures and environmental releases in excess of established limits. By eliminating these exposures and releases, reduce the incidence of illness among workers and the public, and prevent damage to the environment.</i>	1-2. OSH (Lost Workday Case Rate, Cost Index) 3. Electrical Safety 4. Industrial Operations Safety 6. Reportable Occurrences of Releases to the Environment 8. Environmental Permit Exceedances 9. Price-Anderson Amendments Act Enforcement 10. Radiation Dose to the Public 11. Worker Radiation Dose 12. Radiological Events 13. Near Misses and Safety Concerns 14. Inadequate Procedures/Procedures Not Followed 15. Safety System Actuations
<u>Environment, Safety & Health Goal 2</u> <i>Ensure there are specific environmental, safety, and health performance requirements for DOE activities which are the basis for measuring progress toward continuous improvement.</i>	1-2. OSH (Lost Workday Case Rate, Cost Index) 11. Worker Radiation Dose 12. Radiological Events
<u>Environment, Safety & Health Goal 3</u> <i>Establish clear environmental, safety, and health priorities and manage all activities in proactive ways that effectively and significantly increase protection to the environment and to public and worker safety and health.</i>	20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved 21. Plutonium Stabilization 23. HEU Vulnerabilities Resolved
<u>Environment, Safety & Health Goal 4</u> <i>Demonstrate respectable performance related to environmental protection and worker/public safety and health.</i>	All

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy (DOE) Strategic Plan for environment, safety and health is "ensuring the safety and health of workers and the public and the protection and restoration of the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated. Subsequent reports may evolve to include incorporating the components into an index to represent the combined effect that the activities have on the envelope of safety that protects the worker and the environment as experience is gained and data sources improve.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified in table at the end of this appendix.

Summary of Process

1. Overview

1.1 Initial Performance Measures

2. Data Analysis

2.1 Analyses Performed

2.2 Determining Statistical Significance of Trends

3. Future Plans

B1.1 Initial Performance Measures

The performance measures included in this report are identified in the following table. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)* - a system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.
- *Computerized Accident/Incident Reporting System (CAIRS)* - a system for collecting data associated with occupational injury and illness events and statistics.
- *Radiation Exposure Monitoring System (REMS)* - a system for collecting data on individual radiation doses received by DOE complex workers.
- *Environmental Compliance Database* - a system maintained by the Office of Environmental Policy and Assistance.
- *Annual Site Environmental Reports*.

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Further, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

PI Component	Data Source
I. Accidents/Events	
1 Lost Workday Case Rate	Computerized Accident/Incident Reporting System, EH-51
2 Occupational Safety & Health Cost Index	Computerized Accident/Incident Reporting System, EH-51
3 Electrical Safety	Review of Occurrence Reports, EH-33 Defense Programs Review of Occurrence Reports
4 Industrial Operations Safety	Review of Occurrence Reports, EH-33 Defense Programs Review of Occurrence Reports
5 Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/Occurrence Reporting and Processing System, EH-52/EH-53/BNL
6 Reportable Occurrences of Releases to the Environment	Review of Occurrence Reports, EH-33
7 Cited Environmental Violations	Environmental Compliance Tracking Database, EH-41
8 Environmental Permit Exceedances	Annual Site Environmental Reports, EH-41
9 Price-Anderson Amendments Act Enforcement	Office of Enforcement and Investigation database
10 Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
11 Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
12 Radiological Events	Review of Occurrence Reports, EH-33
II. Precursors	
13 Near Misses & Safety Concerns	Review of Occurrence Reports, EH-33
14 Inadequate Procedures/Procedures Not Followed	Review of Occurrence Reports, EH-33
15 Safety System Actuations	Review of Occurrence Reports, EH-33
16 Safety Equipment Degradation	Review of Occurrence Reports, EH-33
III. ES&H Management	
17 Environmental Compliance Milestones Met	EM Progress Tracking System (PTS), EH-41
18 Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
19 Enhanced Work Planning Implementation	Office of Field Support, EH-53
IV. Hazards	
20 Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-60; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-37
21 Plutonium Stabilization	Nuclear Materials Stabilization Task Group Quarterly Report, Data tracked by Brookhaven National Laboratory, EM-66
22 Waste Generation	Waste Minimization Reporting System, Office of Environmental Management
23 HEU Vulnerabilities Resolved	Highly Enriched Uranium Working Group Report on Environmental, Safety & Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium, EH-32

B2. Data Analysis

B2.1 Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- looking for statistically significant trends over time,
- comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. The two most recent quarters are excluded for data originating from CAIRS to account for the time lag in data reporting.

Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

B2.2 Determining Statistical Significance of Trends

The Multinomial Likelihood Ratio Test (MLRT) is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events.

MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: "If the data are generated by a constant trend multinomial model, what is the probability of observing

a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

Significance Level	Conclusion
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

B3. Future Plans

This report is considered a "work in progress". Future activities are focused on obtaining feedback on the approach and improving the effectiveness of the product, including:

- Developing, in partnership with the field organizations, performance indicators that provide a measure of how well DOE is doing in (a) reducing hazards or vulnerabilities and (b) safety management including training, management involvement, and worker involvement. These new measures, combined with measures currently available, will more ably answer the critical questions of "what is DOE's actual and potential impact on people and the environment" and "is DOE getting safer."
- Providing more normalized or risk-based data that lends itself better to analysis and comparison.
- Establishment of Corporate goals for most indicators and comparison to average and best-in-class companies.
- Internet web-based tools to provide up-to-date data and charts of most performance indicators.

Future reports will be refined as data are gathered and customer input is received. Over time, new knowledge and changing missions will be reflected in the process.

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Glossary

Baselines provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data which originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes. In addition, the graphs show the historical baseline ± 1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

Multinomial Likelihood Ratio Test (MLRT)

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The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

Total Effective Dose Equivalent (TEDE)

TEDE = External Dose Contribution + Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the "legacy" doses from previous years' exposures resulted in lower reported doses.

Price-Anderson Amendments Act (PAAA)

Price-Anderson Amendments Act (PAAA). The 1988 Price-Anderson Amendments Act extended indemnification to DOE operating contractors for consequences of a nuclear incident. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate nuclear safety rules. The regulatory basis for the enforcement program is published in 10CFR820, Procedural Rules for DOE Nuclear Activities. Enforcement actions may include the issuance of Notices of Violations and, where appropriate, civil monetary penalties of up to \$100,000 per violation per day. The mechanism allows DOE to penalize a contractor for unsafe actions or conditions while providing positive incentives for contractors to strive for an enhanced nuclear safety culture through attention to compliance to standards and

requirements, self-identification of problems, reporting noncompliance's to DOE and initiating timely and effective corrective actions.

Enhanced Work Planning (EWP) is a process that evaluates and improves the program by which work is identified, planned, and executed in an efficient manner. The key elements of EWP are: a graded approach to work management, diverse teams, institutionalized communication and worker involvement from the beginning.

Enhanced Work Planning (EWP)

The following terms are related to occurrence reporting, as required by DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Occurrence categories are arranged into 10 generic groups related to DOE operations and include the following:

Occurrence Categories (types of occurrences)

- 1. Facility Condition
- 2. Environmental
- 3. Personnel Safety
- 4. Personnel Radiation Protection
- 5. Safeguards and Security
- 6. Transportation
- 7. Value Basis Reporting
- 8. Facility Status
- 9. Nuclear Explosive Safety
- 10. Cross-Category Items

Severity of occurrence indicates the degree of significance associated with the different types of occurrences.

Severity of Occurrence

Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.

Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

Facility function identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

Facility Function

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage
- Reprocessing
- Nuclear Waste Operations
- Tritium Activities

Causes of Occurrences

- Fusion Activities
- Environmental Restoration Operations
- Category "A" Reactors
- Category "B" Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

Causes of occurrences are determined by performing event investigations and may be identified as direct, contributing, or root causes.

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that by itself, would not have caused the occurrence.
- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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Product Improvement Survey Form

Purpose of the Product - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in its strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

1. Do you use indicators to measure performance? ☐ Yes ☐ No
2. Do you feel that improved methods for measuring performance are needed? ☐ Yes ☐ No
3. Would you make management decisions based on this kind of information? ☐ Yes ☐ No
4. Does DOE-wide ES&H performance matter to you? ☐ Yes ☐ No
5. What are your information needs with regard to measuring Department-wide ES&H success:
 - ☐ Quick pulse of the Department ES&H success
 - ☐ Light detail concerning the Department ES&H success
 - ☐ Moderate detail concerning the Department ES&H success
 - ☐ I have no need for this information on a regular basis

Report Evaluation - From your review of this report, *and in consideration of the purpose stated above*, mark the number that most closely corresponds to your reaction to the following statements

- | | <i>Strongly
Agree</i> | | | | <i>Neutral</i> | | | <i>Strongly
Disagree</i> |
|---|----------------------------------|---|---|---|-----------------------|------------------------------|-----------------------------|-------------------------------------|
| 6. The performance indicators are relevant to the measurement of overall DOE ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 7. The report layout (text and graphics) is logical and easy to understand. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 8. The data presented in this report are consistent with my impressions of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 9. The performance indicators provide a "balanced" view (e.g., successes and problems) of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 10. This report concept can help measure DOE's success in managing and improving its ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 11. This report concept can be useful in communicating information on DOE's ES&H performance to external customers. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① | |
| 12. Would you be willing to expend time/travel funds to participate in product improvement sessions? | | | | | | <input type="checkbox"/> Yes | <input type="checkbox"/> No | |
| 13. Based upon your stated needs, does this report meet your expectations? | | | | | | <input type="checkbox"/> Yes | <input type="checkbox"/> No | |

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Comments: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and any general observations based on your review. Use additional pages as necessary.